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MINERALS YEARBOOK

Volume III

1995 INTERNATIONAL REVIEW

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MINERAL INDUSTRIES OF LATIN AMERICA AND CANADA

U.S. DEPARTMENT OF THE INTERIOR

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MINERALS YEARBOOK

AREA REPORTS: INTERNATIONAL 1995

MINERAL INDUSTRIES OF LATIN AMERICA AND CANADA

Volume III

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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UNITED STATES DEPARTMENT OF THE INTERIOR • Bruce Babbitt, Secretary

GEOLOGICAL SURVEY

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people by encouraging care. The Department also has a major responsibility for Native American reservation communities and for people who live in Island Territories under U.S. administration.

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1995, and it provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial minerals industries in the United States are also included.

Volume II, Area Reports: Domestic, contains a chapter on the minerals industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has a chapter on survey methods and summary statistics for domestic nonfuel minerals.

Volume III, Area Reports: International, is published in four separate reports. These reports collectively contain the latest available mineral data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and utilization of minerals in each country of the region and how they relate to U.S. industry. Most chapters include production and industry structure tables, information about Government policies and programs affecting the country's minerals industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Gordon P. Eaton
Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed by the Internet at http://www.usgs.gov/. Geologic information on topics such as earthquakes, volcanoes, energy, and mineral resources is available by contacting the Geologic Inquiries Group at (703) 648-4383. Map, digital data, and aerial photography products and information are available by contacting the Earth Science Information Center at 1-800-USA-MAPS. Water data and information may be obtained by contacting the Water Information Center at 1-800-426-9000. For specific information about this publication, contact the Chief, International Minerals Section, Minerals Information Team, at (703) 648-7732 or e-mail at eshekar@usgs.gov or the Chief, Publication Services Section, Minerals Information Team (703) 648-4750 or e-mail at kharris@usgs.gov. General information about the Minerals Information Team may be accessed by the Internet at http://minerals.er.usgs.gov/minerals/.

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Acknowledgments

The Country Specialists in the Minerals Information Team, U.S. Geological Survey, in preparing the International Review regional books of Volume III of the Minerals Yearbook, extensively utilized statistics and data on mineral production, consumption, and trade provided by various foreign government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by the 10 Regional Resource Officers assigned to minerals and petroleum reporting and by economic and commercial officers and other officials of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Acting Chief Scientist, Minerals Information Team

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THE MINERAL INDUSTRY OF

LATIN AMERICA AND CANADA[1]

By David B. Doan, Alfredo C. Gurmendi, Ivette E. Torres, and Pablo Velasco

INTRODUCTION

Mining and related activity in roughly 40 countries and territories of Latin America, Canada, and the Caribbean Basin during 1995 are described in this regional report. As with the United States, these other countries of the Western Hemisphere are endowed with a great diversity of minerals, comprising metals, industrial minerals, and energy minerals. For many of the countries in this study, the mining, processing, and marketing of these mineral commodities play a significant role in the foundations of their economies, in many cases earning export revenues in hard currencies.

Table 1 depicts a synopsis of Latin America and Canada's production of their major mineral commodities during 1995. Table 2 shows the role of Latin America and Canada in world mineral production.

The rich and varied mineral endowment of Latin America and Canada, taken together, complement the mineral resources of the United States. New interest and capital investment are attracted to many of these countries, as discussed in the ensuing country chapters.

Position in the World Mineral Economy

By itself, Latin America produced 40% of the world's silver and 20% to 33% of the world's total output of copper, tin, bauxite, iron ore, zinc, and, with Canada, produced even greater proportions of silver (49%), copper (40%), and zinc (36%).[2] Likewise, in combination with Canada, Latin America produced 32% of the world's nickel, 26% of its iron ore, 24% of its lead, and 22% of the world's primary aluminum. Moreover, Latin America and Canada, separately and together, are of great significance to the world economy as producers of petroleum crude and natural gas, petroleum refinery products, and coal.

Canada led the world in production of uranium and zinc, with a strong showing in output of silver, gold, and nickel. Chile led the world in production of copper while Mexico led in the production of silver, sodium sulfate, and strontium. Brazil led in output of columbium and, although not the greatest producer of iron ore, was the largest exporter in recent years, as well as eighth largest steel producer in the world, followed in the Western Hemisphere by Canada and Mexico as second and third largest producers of steel. Brazil was also the fifth ranking source of manganese in the world, followed in Latin America by Mexico. After Russia, Canada was the second largest world nickel producer, with other significant production in the hemisphere by Cuba and the Dominican Republic.

The inclusion of the United States in summary table 1 shows the position of the entire Western Hemisphere in world supply of mineral commodities. This hemisphere produced significantly more than one-half of the world's silver (60%) and copper (58%), as well as 45% of its zinc, 39% of its aluminum, 38% of its lead, and 32% of the world's nickel and iron ore. Among the industrial minerals, in 1995 the Western Hemisphere produced 46% of the world's sulfur, 39% of its salt, 34% of its phosphate rock, and 33% of its gypsum. Of the mineral fuels, this hemisphere produced 37% of the world's output of natural gas, 26% of its crude, and 24% of its coal; further in the processing stream, it produced 33% of refined petroleum products.

Production Trends

Nonfuel Minerals.—For all of Latin America, the most significant production of the region in terms of share of world output includes silver, copper, tin, bauxite, iron ore, zinc, lead, nickel, gold, and primary aluminum, in order of importance, as shown in table 2. In the past 10 years, exploration, investment, and development have taken various new discoveries to the point of production such that tin, copper, nickel, bauxite, and iron ore have increased Latin America's world position in production of these metals.

In certain years, some of this activity seems to have been at the expense of silver, zinc, and lead, which have either declined in terms of their proportion of world production or fluctuated erratically in terms of world share. This is partly because of changes in output in other countries. It may be noted that Latin America's world share of output of bauxite and gold has notchanged much in the past 5 years, but conspicuous effort is being exerted to find and produce these minerals. Gold has been the center of attention in the Guyana Shield of Venezuela and Guyana as well as virtually all of the Andean countries. The bauxite

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industry has weathered the unusual surge of aluminum exports from the former Soviet Union during the early 1990's and is the object of increased interest in Brazil and Venezuela for domestic aluminum production. Jamaica, the biggest Latin American bauxite producer, exports virtually all of its production.

Energy Minerals.—World share of Latin American production of petroleum crude (12%), natural gas (5%), and resultant petroleum products (7%) dropped moderately in 1995 after fluctuating unevenly since 1985. In spite of this, however, new highs in output of crude were achieved by Bolivia, Colombia, and Cuba. The top seven producers were Mexico, Venezuela, Argentina, Brazil, Colombia, Ecuador, and Trinidad, representing 97.5% of the regional total. Bolivia and Colombia also reached new highs in production of natural gas.

Canada likewise confirmed a new high in production of both crude and natural gas and, if combined with Latin America and the United States, showed the Western Hemisphere to represent 37% of the world share of natural gas production and 26% of crude oil production. Mexico, Brazil, and Venezuela, in order of output, led Latin American production of refinery products and, with Canada and the United States, the region achieved a world share of 33%.

Coal output in Latin America was led by Colombia, Mexico, and Venezuela, in that order, with products that were generally competitive in world markets while increasing local and regional market share over the past 10 to 20 years. These coals range from anthracite through semianthracite, bituminous, and subbituminous, depending upon the country, plus some lignites used locally in most cases. Latin American coals are suitable for both metallurgical and thermal use, as is true for Canadian and U.S. coals. Together, the Western Hemisphere coal output amounts to a 24% world share.

Trade Liberalization Developments

Canada, Mexico, and the United States ratified the North American Free Trade Agreement (NAFTA) that went into effect on the first day of 1994. This agreement created the largest and richest trading bloc in the world, including 370 million consumers and an annual output approximating $7 trillion. NAFTA automatically replaced the Free Trade Agreement between the United States and Canada after 5 years of generally successful operation. The excellent infrastructural connections between Canada, the United States, and Mexico, including railroads, highways, and pipelines, were expected to be a significant factor in the marketing of mineral commodities. Other Latin American nations, Chile in particular, viewed the possibility of joining NAFTA to enable greater freedom of mineral trade and, ultimately, greater efficiencies of production. A first step in this direction was under discussion by Chile and Canada, with the hope of negotiating a Free Trade Agreement between those two countries.

Other Latin American countries, over the past 30 years or more, have entered trade agreements among themselves, such as the Southern Cone Common Market (MERCOSUR) including Argentina, Brazil, Paraguay, and Uruguay; Chile's bilateral Free Trade Agreement with Mexico; the Venezuela and Colombia agreement with the Central American Common Market; Venezuela's agreement with Chile to begin phasing out tariffs over a 6-year period; and a free trade pact between Colombia, Mexico, and Venezuela to phase out tariffs.

During MERCOSUR negotiations Brazil discussed measures to lower its average tariff to approximately 14% and abolish the 40% ceiling on foreign investor stockholdings in privatized companies. Brazil also signed an agreement with Peru to reduce tariffs on bilateral trade by 50%. Chile signed an agreement with Colombia to eliminate tariffs entirely by 1999. In 1993, Argentina signed a bilateral investment treaty with the United States guaranteeing U.S. investors the best of national or most-favored-nation treatment, free transfer of profits, and access to international arbitration.

Privatization and Investment Interest

Many governments recognize that privatization of ownership and acceptance of foreign investment fosters vigorous growth, not least in the mining industry, leading to enhanced revenues and, for many countries, expanded overall economic strength in labor and wages. The year 1995 saw the continuation of a strong trend toward privatization in Latin America. A significant proportion of U.S. and Canadian interest, along with mining development capital, was shifting to Latin America. Among the most popular geologic exploration targets were the Cordillera and the Guyana Shield. The Cordillera extends southward through Mexico and Central America to the Andes of South America, virtually to Tierra del Fuego. The Guyana Shield comprises parts of northern Brazil and smaller countries between Brazil and the northern coast.

The lure of rights to private ownership in Latin American countries such as Argentina, Bolivia, Chile, Colombia, Ecuador, Guyana, Mexico, Peru, and Venezuela attracted great interest in the mineral endowment of those countries. Even Cuba, seeking sources of hard currency for its economy, increasingly permitted exploration efforts by foreign companies for metals and petroleum while entering negotiations to formalize its long-term processing of nickel matte in Canada.

Venezuela courted foreign exploration for metals, particularly gold, and encouraged joint efforts in petroleum operations. The gold rush, now several years old, persisted around "Kilometre 88" on Highway 10 south of El Dorado, the site of the Las Cristinas (Placer Dome,

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70%, Government, 30%) major gold project. Many other companies, mostly but not entirely U.S. and Canadian, acquired concessions throughout this area, roughly 30 kilometers (km) by 45 km. Although public concern remained high over mercury pollution in the Las Cristinas area from old garimpeiros' (unauthorized miners) panning operations, interest did not stop there. Many of the same companies explored for gold and diamonds toward the south and east, throughout the Guyana Shield but north of the Brazil border, through Guyana, Suriname, and French Guinea.

Brazil, itself highly mineralized and a major player in the mining world, awaited congressional ratification of new constitutional provisions on privatization and foreign investment. By keeping inflation under control via its new currency, the "Real," Brazil has established a favorable climate for investment and especially the privatization of state-owned companies. This new stabilization plan has invoked stricter control of the domestic deficit, stable rules for repatriation of capital and profits, stable foreign exchange rates, reduction of tax burdens, renegotiation of international debt, and the reduction of tariffs and nontariff barriers.

Privatization of business ownership and operations advanced at varying rates in countries such as Argentina, Bolivia, Chile, Colombia, Ecuador, and Peru and was anticipated in others.

After adopting new mining and environmental laws in 1992, Mexico continued its privatizing efforts but was hindered by the collapse of the peso at the end of 1994 and into 1995, which resulted in a strong economic recession and financial uncertainty. Plans for privatization of the petrochemical industry went forward, but with waning enthusiasm.

For the present, privatization in Chile extended only to joint ventures with the Government parastatal companies. The state-owned Comision Chilena del Cobre (CODELCO) was still negotiating on a joint venture with the Cyprus Amax Mineral Co. (U.S.) on the El Abra copper project, according to CODELCO. Commitments in the $4 billion to $6 billion range in major capital investments were being considered for this and a number of other new copper projects or expansions along with several new gold-mining projects in Chile.

Similarly, the Peruvian Government negotiated the sale of its Cerro Verde copper project to the U.S. company Cyprus Mines. Other negotiations resulted in the sale of the Tintaya copper mine to another U.S. company, Magma Copper. Investment was invited for CENTROMIN, the parastatal base-metal mining company, which intended the sale of each of its seven mines.

The Corporacion Minera de Bolivia, widely known as COMIBOL and once the leading mineral producer in the country, sought private partners to operate its existing mines under joint-venture or other contracts. The Bolivian Government has undertaken significant legal and regulatory reforms, such as a single income tax rate of 25%, enactment of environmental laws to balance the need for environmental protection against the imperative of sustainable economic development, and a revised mining code ensuring equal treatment of foreign and domestic investors.

In Canada, privatization was not a concern. That country recently has seen increasing environmental challenge to property development, mining, and closure or abandonment. The industry has striven to respond to responsible criticism by way of adopting environmentally acceptable methods of operation. However some companies have chosen to shift their interest elsewhere, particularly to Latin American countries. Otherwise, groups of Canadian citizens representing all views have combined to reconcile conflicting interests between preservation and development. This effort brought together a coalition of Federal and local governments, native peoples, industry, labor unions, and nongovernmental organizations to formulate a common policy integrating public land use, resource development, and the environmental and economic concerns of the nation's people. Progress was evident in 1995, but the work continued.

---

[1]Based on information available as of Dec. 1995.

[2]Unless otherwise noted, all listings of mineral commodities or countries for enumerative or comparative purposes are stated in order of importance based on volumes produced, exported, or imported.

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PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1995

(Thousand metric tons unless otherwise specified)

Country	Metals										
	Aluminum primary metal	Bauxite	Copper mine output	Gold (tons)	Iron ore, (gross weight)	Lead mine output	Nickel mine output	Silver (tons)	Steel, crude	Tin mine output	Zinc, mine output
Argentina	165	--	(1/)	1	--	11	--	48	3,617	--	32
Bolivia	--	--	(1/)	14	--	20	--	425	--	14	146
Brazil	1,180	11,370	49	42	186,000	1	33	55	25,076	22	150
Chile	--	--	2,488	39	8,174	1	--	1,032	1,013	--	30
Colombia	--	2	11	21	734	(1/)	24	6	792	--	(1/)
Costa Rica	--	--	--	1	--	--	--	(1/)	--	--	--
Cuba	--	--	2	--	--	--	41	--	207	--	--
Dominican Republic	--	--	--	3	--	--	49	21	--	--	--
Ecuador	--	--	(1/)	7	--	(1/)	--	(1/)	22	--	(1/)
El Salvador	--	--	--	--	--	--	--	--	10	--	--
Guatemala	--	--	--	(1/)	3	(1/)	--	--	18	--	--
Guyana	--	2,100	--	12	--	--	--	--	--	--	--
Honduras	--	--	(1/)	(1/)	--	2	--	25	--	--	15
Jamaica	--	10,857	--	--	--	--	--	--	25	--	--
Mexico	10	--	332	20	8,523	164	--	2,324	12,128	(1/)	364
Nicaragua	--	--	--	2	--	--	--	2	--	--	--
Panama	--	--	--	1	--	--	--	(1/)	--	--	--
Paraguay	--	--	--	--	--	--	--	--	96	--	--
Peru	--	--	405	53	7,500	233	--	1,908	515	22	682
Suriname	32	3,300		(1/)	--	--	--	--	--	--	--
Trinidad and Tobago	--	--	--	--	--	--	--	--	738	--	--
Uruguay	--	--	--	1	5	--	--	--	40	--	--
Venezuela	630	5,184	--	7	19,484	--	--	--	3,634	--	--
Others 2/	--	--	--	3	--	--	--	--	--	--	--
Total Latin America	2,017	32,813	3,287	227	230,423	432	147	5,846	47,931	58	1,419
Share of world total (percent)	10	30	33	10	22	16	14	40	6	31	20
Canada	2,172	--	729	150	38,560	210	181	1,245	14,415	--	1,111
Total Latin America and Canada	4,189	32,813	4,016	377	268,983	642	328	7,091	62,346	58	2,530
Share of world total (percent)	22	30	40	17	26	24	32	49	8	31	36
United States	3,375	W	1,850	320	62,489	394	2	1,636	95,172	--	644
Total Western Hemisphere 3/	7,564	32,813	5,866	697	331,472	1,036	330	8,727	157,518	58	3,174
Share of world total (percent)	39	30	58	31	32	38	32	60	21	31	45
Total world	19,403	109,167	10,048	2,252	1,031,481	2,707	1,036	14,618	751,704	187	7,120

See footnotes at end of table.

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TABLE 1–Continued
PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1995

(Thousand metric tons unless otherwise specified)

Country	Industrial minerals						Fuels			
	Barite crude	Cement, hydraulic	Gypsum crude	Phosphate rock (P_2O_5)	Salt, all forms	Sulfur, all forms	Coal, all grades	Natural gas, gross (million cubic meters)	Petroleum (million 42-gallon barrels) Crude	Petroleum (million 42-gallon barrels) Products
Argentina	27	6,200	532	--	987	--	210	27,000	265	139
Bolivia	11	869	2	--	5	--	--	5,346	10	10
Brazil	70	25,500	780	700	6,100	261	5,173	8,115	257	458
Chile	3	2,900	550	3	3,000	360	1,500	4,300	4	47
Colombia	21	9,624	450	11	565	75	26,020	7,674	213	94
Costa Rica	--	990	--	--	47	--	--	--	--	4
Cuba	--	1,200	130	--	180	5	--	37	10	60
Dominican Republic	--	1,453		--		--	1	--	--	11
Ecuador	--	3,000	--	--	--	14	--	200	143	45
El Salvador	--	875	5	--	30	--	--	--	--	6
Guatemala	1	1,560	62	--	100	--	--	13	2	5
Guyana	--	--	--	--	--	--	--	--	--	--
Honduras	--	655	26	--	25	--	--	--	--	2
Jamaica	--	524	208	--	19	--	--	--	--	5
Mexico	248	23,971	4,918	180 4/	7,670	2,902	11,233	38,879	957	486
Nicaragua	--	350	13	--	15	--	--	--	--	5
Panama	--	350	--	--	22	--	--	--	--	10
Paraguay	--	600	5	--	--	--	--	--	--	2
Peru	37	2,100	35	12	238	60	80	1,200	47	55
Suriname	--	50	--	--	--	--	--	--	2	--
Trinidad and Tobago	--	600	--	--	--		--	8,000	48	37
Uruguay	(1/)	1,000	145	--	--	2	--	--	--	11
Venezuela	--	7,000	135	23	350	180	4,700	45,000	868	369
Others 5/	--	580	--	--	1,526	75	--	35	(1/)	59
Total Latin America	418	91,951	7,996	929	20,879	3,934	48,917	145,799	2,826	1,853
Share of world total (percent)	9	6	8	2	11	7	1	5	12	7
Canada	57	10,722	7,956	--	10,893	9,010	74,916	192,530	662 6/	650
Total Latin America and Canada	475	102,673	15,952	929	31,772	12,944	123,833	338,329	3,488	2,503
Share of world total (percent)	11	7	16	2	17	24	3	12	15	10
United States	543	78,320	16,587	12,765	42,150	11,770	934,128	679,834	2,394	5,838
Total Western Hemisphere 3/	1,018	180,993	32,539	13,694	73,922	24,714	1,057,961	1,018,163	5,882	8,341
Share of world total (percent)	23	13	33	34	39	46	24	37	26	33
Total world	4,412	1,420,000	98,127	40,146	188,686	54,258	4,484,000	2,750,170	22,703	25,240

W Withheld to avoid disclosing company proprietary data.
1/ Less than 1/2 unit.
2/ Includes French Guiana.
3/ Excludes Greenland.
4/ Includes only output used to manufacture fertilizers.
5/ Includes Aruba, The Bahamas, Barbados, French Guiana, Guadeloupe, Haiti, Martinique, the Netherlands Antilles, and St. Kitts and Nevis.
6/ Includes synthetic crude (from oil shale and/or tar sands).

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TABLE 2
THE ROLE OF LATIN AMERICA IN WORLD MINERAL PRODUCTION

(Percent of world output) 1/

Commodity	1985	1990	1992	1993	1994	1995
Silver	35	35	34	31	39	33
Copper	26	26	28	30	31	33
Tin	25	28	31	32	32	31
Bauxite	20	24	28	28	28	30
Iron ore	17	21	21	20	22	22
Zinc	17	17	17	13	19	20
Lead	15	13	12	10	16	16
Nickel	6 e/	11	12	12	15	14
Crude oil	12	11	12	9	15	12
Gold	10	9	9	9	9	10
Aluminum	8	10	10	10	10	10
Petroleum products	7	9	9	9	8	7
Cement	7	7	7	7	7	6
Steel	5	5	5	6	6	6
Coal	1 r/	1	1	1	1	1

e/ Estimated. r/ Revised.
1/ By weight.

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THE MINERAL INDUSTRY OF

ANTARCTICA

By David B. Doan

A large continent having an area of about 14 million square kilometers, Antarctica lies almost entirely within the Antarctic Circle. It is virtually surrounded by deep ocean basins and supports an ice sheet varying from 1,500 to about 3,900 meters thick.[1] Through a period of years, geophysical studies have revealed a fairly complete physiographic picture beneath the ice cover. West Antarctica is connected to the main part of the continent by a mountain chain rising well above sea level, though largely masked by ice and snow. The mountains of Marie Byrd Land are a large island mass whose surrounding ice extends well below sea level. The bedrock of most of East Antarctica apparently rises above sea level, with the high ranges of the Transantarctic Mountains and Queen Maud Land extending far above sea level.

The Antarctic continent, with its accompanying continental ice sheet and widely distributed mountain glaciers, is unique at the planetary surface, being at once the coldest area on earth, the least inhabited continent, the southern pole, and the locus of the greatest impoundment of fresh water on earth. Moreover, it has a distinct fauna and flora, relating evidently both to temperature and the uniqueness of the land mass as a major continent. Exploration began piecemeal and by accident in the early 1800's, primarily by whale and seal hunters, and increased gradually toward the so-called Heroic Era, from 1894 to the late 1920's. During this 35-year period, explorers from a number of countries established bases, planted their flags at the pole, and made claims of land on behalf of their countries. Starting in the 1940's, geopolitical interest and contention rose sharply. By the early 1960's, scientifically sophisticated bases were established and overland expeditions mounted by many countries.[2] Intentions may have been diverse but most countries maintained a public posture of scientific objectivity. Accommodation among countries, however, evidently became desirable.

International Policies and Programs

The Antarctica Treaty, signed in December 1959, took effect in June 1961, and established for at least 30 years a legal framework for peaceful use, scientific research, and suspension of territorial claims. Administration has been carried out through consultative member meetings, the 14th and latest meeting having been held in Rio de Janeiro, Brazil, in October 1987.[3]

Consultative (voting) members include claimant nations, who claim somewhat overlapping portions of Antarctica as national territory, and nonclaimant nations, who have made no claims to Antarctic territory, although among the latter the United States and the former Soviet Union have reserved that right and also do not recognize the claims of others.

Argentina and Chile are signatories of the 1961 Antarctica Treaty and are among the seven countries making claims on Antarctic territories. The other five claimant nations are Australia, Britain, France, New Zealand, and Norway.

In October 1985, Uruguay achieved Consultative Party status within the Treaty. Cuba and Peru are acceding (nonvoting) members. Argentina and Chile maintain research stations in Antarctica. Of all the claimant nations, Argentina has had the longest presence in Antarctica, starting in 1904. Argentina and Chile have signed an agreement, the Convention on the Regulation of Antarctic Mineral Resources Activities (CRAMRA), negotiated by the Antarctica Treaty nations during 1982-88.

In 1990, two concurrent resolutions were passed by the U.S. Congress: House of Representatives Concurrent Resolution 109 and Senate Concurrent Resolution 26, both of which declared that it is U.S. policy to pursue an indefinite or permanent ban on commercial mineral development activities in Antarctica. Both resolutions received widespread bipartisan support as well as the backing of major environmental groups.

The Madrid Antarctica Treaty Conference, held in Spain in June 1991, saw near unanimity among the consultative and nonclaimant nations concerning a 50-year protected future for Antarctica. The United States, however, acceded to a compromise stating, in effect, that any of the parties wishing to mine after 50 years may do so only if agreed to by three-quarters of the 26 consultative nations.

These matters having been settled, attention of most of the consultative and acceding nations turned to environmental problems and issues during ensuing years. Procedures for environmental monitoring were discussed at a meeting in Buenos Aires, and the activities most likely to have environmental consequences were considered to be, in order of significance: station and airstrip construction and operations; waste water and sewage disposal;

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incineration of waste; power and heat generation; human activities affecting native fauna and flora; scientific research activities; and accidents causing fuel spills or other types of evironmental contamination. Recommendations were taken up on the establishment of environmental monitoring techniques and programs to be considered in detail in future meetings.

Mineral Potential

What is known of the geology of Antarctica, together with additional evidence from a great many mineral prospects in the small proportion of rocks actually exposed, suggests that a significant potential for the occurrence of mineral deposits occurs in various parts of the continent.[4] Geologic work pointing to this conclusion has been published by geologists from Argentina, Australia, Canada, China, Germany, New Zealand, Norway, South Africa, the United Kingdom, the United States, and the former U.S.S.R. Known metalliferous fold belts in Africa, Australia, and South America appear to have continuations in Antarctica, based on general concepts of plate tectonics. Although much evidence is circumstantial, a reasonable basis exists for projecting various high-probability areas of ore-grade mineralization in Antarctica.

Some copper-bearing plutons on the Antarctic peninsula have distinct similarities to the Andean porphyry copper bodies. The Dufek Massif, a major intrusion near the African end of the Transantarctic Mountains, bears some resemblance to, and is potentially larger than, the Bushveld Complex in South Africa. Although the geology of the two complexes is comparable, they are different in geologic age.[5]

Based on geologic structure and geophysical evidence, a clear possibility exists that petroleum reserves are likely to be present, particularly offshore in such thick sedimentary basins as those of the Amery Ice Shelf, Filchner Ice Shelf, Ronne Ice Shelf, Ross Sea and Ice Shelf, and the Weddell Sea.[6] Shows of petroleum and natural gas were encountered during the U.S. Deep Sea Drilling Program Leg 28 in 1973 on the continental shelf in the Ross Sea area.[7] The discovery of hydrocarbons along the Atlantic coasts of Africa and South America, the east coast of India, and the south coast of Australia underscores the possibility of similar accumulations along the coasts of Antarctica that were once in proximity[8] to these petroliferous margins of other continents.

Infrastructure

The infrastructure of Antarctica consists of temporary and permanent scientific stations that have been established originally by Argentina, Australia, Chile, France, the Federal Republic of Germany, Great Britain, India, Japan, New Zealand, the Republic of South Africa, the United States, and the U.S.S.R. Names of the countries have changed in some cases, but these stations are, or have been, supplied by ships and airplanes using about 39 different temporary airstrips. There are no true port facilities, only offshore anchorage. Antarctica has no indigenous inhabitants. The total number of foreign inhabitants varies up to about 4,000, depending on the time of year.

Outlook

The CRAMRA Treaty, adopted in Wellington, New Zealand, in June 1988 sought, among other things, to regulate a controlled, rational approach to future mineral exploration activities in the Antarctic. Three years later, however, the Madrid conference ultimately agreed to a 50-year moratorium on mineral exploration and mining, thus defining the outlook for the foreseeable future. Antarctica's remoteness, its harsh climate, the ice coverage of 98% of its surface, the question of suitable mining-related technology, the abundance of minerals elsewhere, and the opposition of environmentalists and conservationists are additional factors that would affect any efforts toward mineral extraction or development.

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[1]Unless otherwise noted, this and other geological or geophysical information is taken from Petroleum and Mineral Resources of Antarctica. Behrendt, John C., Editor, U.S. Geological Survey Circular 909, in cooperation with the National Science Foundation, Washington, DC, 1983, p. 7 et seq.

[2]National Geographic Society. Antarctica, Atlas Plate 65 (heavily annotated), 1:9,820,800 scale, Feb. 1963, Washington DC.

[3]U.S. Department of State. Various telegrams, beginning June 1988 until Sept. 1991, regarding Antarctica treaty negotiations.

[4]Rowley, Peter D., Paul D.Williams, and Douglas E. Pride. Mineral Occurrences of Antarctica, *in* U.S. Geological Survey Circular 909, in cooperation with the National Science Foundation, 1983, p. 25 et seq.

[5]Ford, Arthur B. The Dufek Intrusion of Antarctica and a Survey of its Minor Metals and Possible Resources, *in* U.S. Geological Survey Circular 909, in cooperation with the National Science Foundation, 1983, p. 51-75.

[6]Cooper, Alan K., Frederick J. Davey, and Karl Hinz, (Office of Marine Geology, U.S. Geological Survey). Ross Sea– Geology, Hydrocarbon Potential, Oil and Gas Journal, Nov. 7, 1988, pp. 54-58, and Nov. 14, 1988, pp.118-125.

[7]Hayes, D. E., and L. A. Frakes. General Synthesis, Deep Sea Drilling Project Leg 28, in Initial Reports of the Deep Sea Drilling Project: v. 28, Washington DC, U.S. Government Printing Office, pp. 919-941.

[8]Various reconstructions have been proposed since 1968; one of these is shown in footnote 1, above.

Major Sources of Information

National Science Foundation
Office of Polar Programs
1401 Wilson Blvd.
Arlington, Virginia 20192
Telephone 703-306-1030

U.S. Geological Survey
Scientific Committee on Antarctic Research (SCAR)

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Library
Has airphotos, maps, charts, and satellite images
12201 Sunrise Valley Drive
Reston, Virginia 20192
Telephone: 703-648-6600

Major Publications

American Geophysical Union, Washington, DC:

Mineral Resources Potential of Antarctica, 1990, 310 pp.
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ARGENTINA

By Pablo Velasco

In 1995, Argentina with a population of more than 34 million, had a gross domestic product (GDP) of about $283 billion.[2] Minerals and related industries, excluding hydrocarbons, accounted for less than 1% of Argentina's 1995 GDP. Metallic mineral exports represented about 8.4%; nonmetallic minerals, 23.6%; construction materials, 67.8%; and semiprecious stones, 0.3% of Argentina's $506 million total nonfuel mineral exports. Argentina, the second largest country in South America after Brazil, continued to be a modest producer of minerals. The 1995-99 5-year government plan for the mineral sector has been programmed to help promote exploration and development.

In 1995, Argentina continued its self-sufficiency in energy resources (natural gas, petroleum, and uranium) and was a large producer of electricity. Argentina was the fourth largest producer of crude oil and natural gas in Latin America and ranked third in world production of boron minerals. Argentina had the most advanced nuclear energy program in Latin America, with two nuclear plants in operation and a third one under construction (temporarily discontinued due to budgetary constraints). Nuclear plants provided 7,750 megawatts (MW) of electric power to Argentina in 1995, or 13.1% of the total of 58,958 MW.

Throughout 1995, a year of financial crisis, the government continued with policies originally outlined in 1989. It also accelerated its economic reform efforts, including those targeted to increase domestic and foreign investment. Deregulation and privatization of major Argentine industries set off a boom in the oil industry, which became open for exploration and production. Yacimientos Petrolíferos Fiscales Sociedad Anónima (YPF) S.A., privatized since 1991, saw its market capitalization reach to more than $9 billion in assets; in 1995 it had a net income of $793 million.

Argentina is a member of the Southern Common Market (Mercosur), the world's fourth largest trading block. The European Union (EU), the world's largest trading block, and Mercosur signed an accord paving the way for closer economic and political ties between the two entities. The EU-Mercosur Inter-Regional Framework Cooperation Agreement was finalized December 15, 1995, in Madrid by the 15-member EU. The accord still must be ratified by the governments of all 19 countries involved.

Government Policies and Programs

Argentina's mining code was enacted in 1966; since then there have been several amendments. The most recent updating occurred in August 1980 (Mining Code No. 22,259). The 1980 Mining Code was further clarified in 1995 with passage of the Federal Mining Agreement (law 24,228), the Mining Reorganization Law (law 24,224), and the Mining Investment Law (law 24,196). The adoption of these laws was the direct result of the Federal Government having appointed a Secretary of State specifically for the mining sector in December 1995; having been passed, with the full support of both chambers of Congress, they have given rise to a real upsurge in mineral-related activity.

The Mining Investment Law was created to provide a stable business environment for mining activities by alleviating the tax impact on early stages of development and promoting the importation of mining equipment and machinery. It also required individuals and corporations to be domiciled in Argentina and registered with the National Mining Department. The law is applicable in all the provinces that ratified it.

The key incentives provided by the law, in recognition of the special status given to minerals developments, included: (1) tax stability for a 30-years period, during which time municipal, provincial, and national taxes cannot be altered; (2) stable foreign exchange and customs treatment; (3) 100% income tax deductions on the costs of prospecting, exploration, and other studies. Installations under construction are also exempt from corporation tax liability; (4) income tax exemption for profits stemming from capital contributions involving mines and mining rights; (5) accelerated amortization of investments in infrastructure, machinery and equipment; (6) exemption from import duties on capital goods, equipment, and raw materials used in mining and exploration projects; (7) elimination of stamp duties on legal transactions related to mining projects; (8) a limit of 3% royalties based on the mine-mouth value of production; and (9) the ability for companies to establish tax-deductible special funds for environmental protection. This law specifically excluded oil and gas activities, as well as the manufacture of cement, tiles, ceramics, sand, pebbles, and gravel.

Corporate income tax is levied at a standard rate of 30% on a national basis. Individual income tax rises progressively to a maximum of 30%, and nonresidents working temporarily in Argentina receive a concessionaire tax rate of 21%. Value added tax (VAT) is levied on virtually all transactions at a standard rate of 18%. Exports are not subject to VAT. The 1993 Mining Investment Regulation Law also removed a

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costly and cumbersome evaluation of investments.

Argentina's foreign investment rules are covered under the Foreign Investment Law 21,382 as amended by law 22,208, law 23,696, and later by law 23,697 of August 1989. The 1989 law entitled foreign investors to the same rights and made them subject to the same obligations as domestic investors. Foreign investors became entitled, without approvals or formalities, to repatriate capital and remit profits at any time and to have unrestricted access to foreign exchange markets.

Environmental Issues

Argentina initiated a number of measures to regulate, monitor, and improve its environmental standards especially water and air pollution and hazardous-waste disposal. The lack of clear delegation of environmental authority in Argentina has created difficulties in the implementation and enforcement of its environmental law. The Secretariat of Natural Resources and Human Environment (Secretaría de Recursos Naturales y Ambiente Humano [SRNYAH]) was created by Presidential Decree in November 1991, in order to foster environmental cooperation between the national and provincial governments. The SRNYAH was attempting to establish itself as the country's foremost expert, promoter, and enforcer of environmental protection. The first serious national attempt at environmental legislation was achieved by the enactment of the "Law on Hazardous Wastes" (law 24,051 of January 17, 1992, and its implementing bylaws in Decree No. 831 of April 23, 1993). Largely the result of public reaction to recent industrial accidents, the law requires companies to report on the kind and quantity of hazardous wastes they release into the environment as well as to prepare waste abatement plans. Encouraged by the mining law's success and assisted by the Inter-American Development Bank, the SRNYAH was involved in 1995 in drafting a new Federal Law intended to establish minimum levels of environmental quality to be maintained nationwide. The law emulates environmental regulations used in the United States and several European countries. SRNYAH hopes thereby to establish minimum environmental standards that must be met by all provinces.

Production

Argentina continued to be the world's third largest producer and exporter of boron minerals and byproducts, after the United States and Turkey. It also produced modest quantities of base metals, such as cadmium, copper, lead, manganese, and zinc; precious metals, gold and silver and other industrial minerals, such as asbestos, barite, bentonite, clays, celestite, diatomite, feldspar, fluorspar, graphite, gypsum, kaolin, marble, sodium carbonate, and vermiculite. Mineral fuels, such as coal, coke, crude oil, natural gas, and uranium. Argentina's only primary aluminum producer, Aluminios Argentinos, S.A.I.C. (ALUAR), produced about 184,000 metric tons per year (t/yr) of aluminum ingot, billet, and slab. Crude steel production in Argentina increased 9.6% in 1995 to about 3.6 million metric tons (Mt), while domestic consumption increased to 3.1 Mt from 2.7 Mt in 1994. The largest producers of steel in Argentina were Aceros Paraná S.A. (formerly Sociedad Mixta Siderúrgica Argentina-SOMISA) and Acindar Industria Argentina de Aceros S.A., which were privatized in 1993. Production of crude oil increased nearly 10.3% in 1995, and refinery products increased 4.5% in 1995. *(See table 1.)*

Trade

The National Customs Administration and the National Institute of Statistics and Census reported the value of exported nonfuel minerals, mineral-related products, and metals to be approximately $70 million, an increase of 40% compared with that of 1994. The export value of crude oil and refinery products increased 38.3% to $848 million in 1995. Small quantities of crude oil and refinery products were exported to the United States. The following principal nonfuel mineral exports were classified in five groups based on their export value: borates, 25.9%, of which boron minerals were 2.2%, boric acid, 10.3%, and sodium borate, 13.4%; metals, 23.5%, of which refined zinc is 23.0% and refined lead, 0.5%; metallic minerals, 22.5%, of which lead minerals were 19.4% and zinc minerals, 3.1%; granites, 12.0%, of which manufactured is 11.6% and granite in blocks, 0.4%; and others, 16.1%. In 1995, the nonfuel mineral and mineral-related products exported went to 51 countries, including: Brazil, 30.5%; the United States, 15.1%; Belgium, 12.7%; Japan, 8.6%; Chile, 6.1%; Uruguay, 5.1%; Morocco, 4.7%; and Bolivia, 1.1%.

The total amount of steel imported reached 1,281,000 tons (t), of which 65% was from Brazil, 10% from Poland, 5% from South Africa, and the remainder from other countries. In 1995, the steel industry had to import about 1.8 Mt of iron ore and concentrate, for a total value of $61.1 million, and 993,000 t of coal for the coke plants, for a value of $66.4 million.

Structure of the Mineral Industry

The Secretariat of Mines was a unit under the Ministry of Economy and Public Works and Services, one of the eight ministries of the National Executive Branch. The Secretariat of Mines defined and controlled the tasks performed by the National Mining Board and the National Geological Service Board. The Mining Subsecretariat promoted and coordinated mining technology policy, established the development and incorporation of new technologies, and monitored and preserved a single data

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bank of mining and geological information.

Following a privatization process, the nuclear powerplants formerly under The Comisión National de Energía Atómica (CNEA) are now privately operated by Nucleoélectrica Argentina S.A. (NASA), and the construction of the third nuclear powerplant Atucha II has been discontinued due to budgetary constrains.

The mineral industry in the private sector was composed of several mining and manufacturing companies, such as Aluminios Argentinos S.A.I.C. ALUAR, Cementos Loma Negra C.I.A.S.A., Cía. Boroquímica SAMICAF, Cía. Minera Aguilar S.A., Cía. Minera Tea SAMICAF, and Sulfacid SACIF.

In 1996, the largest copper and gold mining company, Minera Alumbrera Ltd., will start operations in Catamarca Province. Additionally hundreds of small metallic and industrial mineral companies were engaged in mining activities throughout Argentina. *(See table 2.)*

At yearend, there were 10.9 million people employed nationwide, of which 7,000 were in the cement industry, 36,000 in the metallurgical plants, 16,000 in the mining sector, and 21,000 in the oil and gas industry.

Commodity Review

Metals

Aluminum.—Primary aluminum in Argentina was produced by ALUAR. ALUAR's refinery in Puerto Madryn, Chubut Province, had installed production capacity of 185,000 t/yr of primary aluminum. ALUAR was studying the possibility of a bond issue to fund a $300 million expansion of its plant at Puerto Madryn. The expansion will boost its annual refined aluminum output by 39.5% to 258,000 t/yr, ALUAR's official said. It would be completed by July 1999 and additional output will be powered by a 120-MW combined-cycle thermoelectric generator to be acquired by ALUAR. The entire extra output from ALUAR is to be sold to export markets. ALUAR already exports around two-thirds of its current output, a large part of it to Chile and Japan. The complex imported in 1995 about 350,000 t/yr of alumina feedstocks from Aluminum Company of America with about one-half coming from Australia and one-half from Brazil.

Copper.—The Bajo de la Alumbrera copper-gold project is located in the Province of Catamarca in northwestern Argentina at an elevation of 2,550 meters (m) above sea level. The project is being developed by Minera Alumbrera Limited, a company owned in equal parts by Mount Isa Mines (MIM) Holdings Limited of Australia and International Musto Explorations, owned by North Limited of Australia (50%). The property is owned by Yacimientos Mineros de Agua de Dionisio (YMAD), that retains a 20% net proceeds royalty interest in the project. Construction work on the project started in 1995 and concentrate production was scheduled to commence in 1997. The project will consist of a conventional truck-shovel open pit mine, copper concentrator, gravity gold circuits, and the necessary infrastructure to support these facilities including power line, concentrate pipeline, access roads, and water well field and pipeline.

A copper-gold concentrate will be produced as well as a quantity of gold doré. The concentrate will be pumped through a 250-kilometer (km) slurry pipeline to a railhead south of San Miguel de Tucumán. After dewatering, the concentrate will be railed to Rosario on the Paraná River for shipping to various smelters in Asia, Brazil, Europe, and the United States. Combined copper concentrate and doré production were scheduled to contain an annual average of 180,000 tons of copper and 20,600 kilograms (kg) of gold over a 20-year mine life. On the basis of construction progress to yearend, Bajo de la Alumbrera was projected to commence production in August 1997, about 2 months earlier than initially forecasted. Long-term copper concentrate sales contracts for one-half of the planned annual production and for the first 10 years have been initiated, with letters of intent for an additional percentage of the production. The remainder will be sold on the spot market.

CAR Exploration Pty. Ltd. of Australia also completed an option agreement with YAMIRI Company of La Rioja to explore the well-known Famatina copper deposit in northwest Argentina.

Argentina was set to become a major world copper producer with the development of the El Pachón copper/molybdenum deposit, containing proven and probable resources of 834 Mt grading 0.62% copper and 0.014% molybdenum using a cutoff grade of 0.40% copper. Canada's Cambior Inc. had a 40% interest in El Pachón and Cía. Minera San José S.A. of Panamá had a 60% interest. Cambior is the project operator with option to increase ownership to 50%. By 1999, Pachón was expected to be among the world's major copper sources.

Gold and Silver.—The main sources of gold and silver production in 1995 were the Angela Mine in Chubut Province in southern Argentina, the Farallón Negro Mine in the northwestern province of Catamarca, and other properties in the mining district owned by YMAD, a company partially owned and controlled by the Province of Catamarca and the Federal Government. YMAD is a mineral producer and was seeking private partners to explore some 25 square kilometers, which includes the Farallón Negro Mine and the Alto de la Blenda Mine. These mines have been producing some 600 kg of gold and 7 t of silver annually. The Angela Mine, an underground operation owned by Cerro Castillo S.A., produced silver as well as gold, plus some base metals.

One of the most interesting developments in gold and silver exploration was in the southern province of Santa Cruz where Minorco-Perez Companac is to bring its Cerro

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Vanguardia gold-silver property into production by 1998 at a cost of $180 million. The project was expected to yield 6 t/yr gold in doré and 60 t/yr silver. Minera Mincorp's feasibility study was completed in 1995, with construction due to start by the end of 1996. Openpit mining and conventional carbon-in-pulp leaching were envisaged, with an anticipated mine life of 15 years. An environmental impact plan approved by officials will be monitored on an annual basis. Minera Mincorp is owned 50-50 by Minorco and the Argentinean industrial group Paras Companac.

Argentina Gold Corp. (ARP) and Barrick Gold were planning an extensive exploration program at their jointlyowned Veladero and Del Carmen properties located on the Argentinian side of the El Indio gold belt of Chile. The 1996-97 program will consist of grid sampling, geologic and alteration mapping, and geophysical techniques, followed by some 9,000 m of drilling with the aim of evaluating areas of hydrothermal alteration for large, bulk tonnage and/or high sulphidisation bonanza-type gold ore bodies. At Veladero, where ARP holds 60% and is operator, several highly altered epithermal and hydrothermal areas have been outlined, with the main precious metal targets being Cerro Pelado and Veladero Sur. At Del Carmen, 60% owned by Barrick, the area is thought to be a geologic extension of Barrick's Tambo and El Indio deposits in Chile.

Tin.—In November 1995, Sunshine Mining and Refining Company, acquired the assets of Soc. Minera Pirquitas Picchetti, historically the largest producer of silver and tin in Argentina. Recent estimates of the reserves at Pirquitas suggest that at least 70,000 t of contained tin and more than 4,043 t of contained silver remain at the deposit. Followup work by Sunshine confirmed the presence of a large disseminated silver and tin resource that could be mined by an openpit method. Pirquitas is located in northwestern Argentina in the province of Jujuy. The Chilean and Bolivian borders lie 50 km west and 60 km north of Pirquitas at 4,100 m above sea level. Sunshine Argentina, Inc., a wholly owned subsidiary of Sunshine Mining and Refining Co.(U.S.), purchased 100% of the Pirquitas mineral and surface rights at a public auction in November 1995.

Iron and Steel.—According to the Government of the Río Negro Province, currently the owner of the Sierra Grande iron ore deposit, production of iron ore in 1995 was limited to about 4,500 t. Argentina imported 3.2 Mt of iron ore concentrate from Brazil (97%) and Chile (3%). Hierro Patagónico Argentino S.A., the new company in charge of the Sierra Grande Mine, announced that an evaluation study of the formerly Hierro Patagónico Sociedad Anonima Minera installation was completed. The study was conducted by Lurgie Metallurgical of Germany, which found the installation highly satisfactory, thus opening up a new perspective for reactivating the entire operation of the company.

Crude steel production in Argentina increased about 9.6% to 3.6 Mt compared with that of 1994, and output of semimanufactured products increased about 9.9% to 3.7 Mt. Meanwhile, apparent domestic consumption of rolled steel products was estimated by the Siderurgical Industry Center of Argentina to be about 3.2 Mt, a decrease of about 20% compared with that of 1994, and a per capita consumption of about 100 kg.

Investment in the iron and steel industry in 1995 amounted to $119 million, compared with $91.7 million in 1994. Siderurgical Industries Grassi, producer of special steel products and ferroalloys, announced its departure to Paraguay, where the government assured the availability of cheaper and convenient energy for long-range planning and promotional industrial benefits and other advantages, such as the proximity to Brazilian manganese in the Alto Paraná River.

Uranium.—Preliminary figures released by the Secretaría de Hidrocarburos indicated that the production of yellow cake uranium (U_3O_8) in 1995 was about 68,000 kg, or 28% lower than that of 1994.

Argentina's CNEA is responsible for nuclear energy development, which also conducts research and development in nuclear physics, radioisotopes, nonconventional energy resources, and nuclear medicine and it operates a complex of research laboratories and institutes and reports to the Ministry of Culture and Education. Nucleoeléctrica Argentina S.A. (NASA), following a privatization process, now operates the two nuclear powerplants formerly under CNEA. Construction on a third nuclear powerplant (Atucha II) has been discontinued due to budgetary constraints. After privatization, NASA became a 60% private company and took over operation of the Atucha I and Embalse nuclear powerplants. In addition, NASA worked with an existing mixed public-private company, ENACE Inc., to complete the Atucha II. The Nuclear Regulatory Agency is responsible for security and safeguards in nuclear installations.

At yearend, the Argentine Congress began to debate a controversial bill to privatize two working power stations and one unfinished plant, the core of Argentina's nuclear program which was begun in the late 1950's and on which the state has spent billions of dollars. Having run out of cash, the State sought an estimated $600 m-$700 million from the private sector to finish Atucha II, a 750 MW plant that has since 1981 cost $2 billion but has yet to produce energy. Cash flows from these two plants, which account for 14% of Argentina's energy consumption, would theoretically pay for Atucha II's completion.

Industrial Minerals

Boron.—Argentina ranked third in the world in boron mineral production with output of borates amounting to

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about 245,000 t in 1995, 13.9% higher compared with that of 1994. The main deposits are in the provinces of Jujuy, Salta, and Catamarca in the Argentine Andes.

The total installed boric acid production capacity in Argentina was about 30,000 t/yr, but currently most of the plants are on standby. The main producer was Norquímica S.A. at 5,400 t/yr. Exports of boric acid were about 11,000 t in 1995.

Cement.—Estimated production of cement was maintained at about the same level as in 1994 of more than 6.2 Mt. For the year, the cement industry operated at about 52% of its installed capacity. According to the Portland Cement Manufacturers' Association, the average consumption of cement per capita increased from 100 t in 1982 to about 150 t in 1995. Total installed production capacity of about 12 million metric tons per year was far in excess of the present domestic requirements. Corporación Cementera Argentina S.A. was adding a cement grinding facility, storage silos, and packing plant to its Mendoza (Capdeville) plant. Startup is expected in early 1996. Juan Minetti S.A. has responded to the building boom in Argentina by ordering from Polysius, a new kiln line (3,100 metric tons per day clinker) for the existing Malagueño plant.

Lithium.—Reportedly, a lithium project is being developed in northwestern Argentina by FMC-LITHCO of the United States at a cost of $50 million. Development was ongoing and the extraction plant will be built in 1996, with the initial production expected in late 1996. Cía Minera Altiplano S.A., wholly owned by U.S.-based FMC Corp., has invested some $45 million since 1991 developing the first stage of the Salar del Hombre Muerto project. The first stage would recover up to 4,500 t/yr lithium carbonate from brines containing lithium compound and between 7,000 t to 15,000 t/yr of lithium salts when in full production. The Salar del Hombre Muerto project, which will become the first major lithium mine outside of (Chile and the United States) was based on an ancient dry evaporated lake bed about 4,000 m (13,200 feet) above sea level in the Andes. Reserves were estimated to be sufficient for 70 years.

Potassium.— CAR Ltd; through its subsidiary CAR Exploration Argentina S.A., has optioned the large undeveloped potash deposits along the Río Colorado, which forms the boundary between the provinces of Mendoza and Neuquén. The current owner is Potasio Río Colorado S.A., a subsidiary of Minera TEA S.A. development by CRA as project manager, including a mining feasibility study, over some 11/2 years will allow CRA to acquire an 89% interest in the deposits.

The reserves at the Río Colorado deposit consisted of a high-grade sylvite ore and were estimated to contain over 1 billion t of potash. The preliminary proposal envisaged producing a 250,000 t/yr of potassium chloride (KCL) valued at an estimated $60 million. A mine with an operating capacity of 500,000 t/yr KCL was under consideration. The cost was estimated at about $100 million.

Mineral Fuels

Argentina's estimated production of commercial energy totaled about 82.3 Mt of standard coal equivalent. Of the total energy produced, solid fuels accounted for only 0.2%; liquid fuel oils, 54.4%; natural gas, 38.4%; and hydropower, 7%. Energy consumption data were not available for years subsequent to 1993, when the total consumption was 68.9 Mt of standard coal equivalent. Solid fuels provided 1.3%; liquid fuels, 40.8%; natural gas, 49.2%; and hydropower, 8.7%. Of the total installed electrical generating capacity of 18,035 MW in 1993, 55.6% was thermal, 38.8% was hydroelectric, and 5.6% was nuclear. In that year, the latest for which complete data were available, a total of 63,038 kilowatt hours was produced, 49.4% by thermal plants, 38.3% by hydroelectric plants, and 12.3% by nuclear plants. Argentina had two operational nuclear powerplants, Atucha I and Embalse. Atucha II (under construction) would utilize the same source of domestic uranium oxide fuel for its power reactor. In September 1994, the $7 billion Yacyretá hydroelectric power project generated its first electricity, after 20 years of work on the Paraná River between northern Argentina and Paraguay; the project was owned by the governments of both countries.

YPF, registered a $793 million profit in 1995, or 41% more than in 1994.

Coal.—Production of bituminous coal in 1995 reached 210,000 t, down 2% from 1994. Yacimientos Carboníferos Fiscales (YCF), the state-owned coal company, produced coal from the Río Turbio Mine in Santa Cruz Province. The Ministry of Economy, Public Work and Services issued a tender for the concession to operate the Río Turbio coal mine and the railway linking the mine to the ports of Punta Loyola and Río Gallegos in Patagonia. The mine and transportation were operated by YCF. This was the second tender for the concession. After restructuring, the privatization process was expected to began.

Natural Gas.—Natural gas production in 1995 was maintained at about 22 billion cubic meters. During 1995, Argentina's proven reserves of natural gas were reported by the recently privatized YPF at about 526 billion cubic meters. Most natural gas produced in Argentina was controlled by YPF. About 53% of the gas was produced by YPF, and the rest either imported from Bolivia or produced under service contracts with private production companies. Gas imports from Bolivia in 1995 amounted to more than 2 billion cubic meters, valued at $91.6 million, which was paid directly by Gas del Estado, the state-owned gas distribution company, now Transportadora de Gas del Norte.

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Natural gas was an important fuel in the Argentine energy mix, accounting for about one-third of Argentina's total energy consumption in 1995. Most gas reserves in Argentina were discovered as a result of oil exploration. Current Argentine gas production was centered on five basins: Noroeste in northern Argentina, Cuyana and Neuquina in the center of the country, and Golfo San Jorge and Austral in the south. Neuquina was the largest of these basins, accounting for approximately 59% of proven reserves. Noroeste ranked second, with about 23% of proven gas reserves. YPF controlled about one-half of Argentina's gas reserves.

The construction of a 700-km natural gas pipeline from Neuquén, Argentina, to Chile was underway in 1995 and was expected to be completed by 1996. The consortium building the pipeline was composed of YPF, Astra, Bridas, San Jorge, and Pluspetrol. The group expected to export 5 million cubic meters per day of natural gas through the pipeline and eventually export liquified natural gas from Chile's Pacific Ocean ports. The group has already signed a contract with Chile's Empresa Nacional de Petróleo to sell the gas at a rate of $1.35 per million british thermal unit. The operator of the trunk pipeline was to be Tenneco of the United States, while British Gas was to be in charge of the urban distribution network within Chile.

Petroleum.—The deregulation and privatization of major Argentine industries started a boom in the oil industry, which became open for exploration and production. As a result, Argentine oil production has increased in recent years. Oil production in 1995, according to YPF, was 265 million barrels, an increase of 10.4% compared with 1994. The company, which accounted for 43% of the total production, opened up several central and secondary areas to the private sector.

YPF, announced the discovery of an important crude oil and natural gas field in the northern province of Salta. The San Pedrito X-1 prospection in Acambuco, registered a flow of natural gas and condensate equivalent to 9,500 barrels per day of crude oil, which volume was classified among the largest productive wells in the country.

Infrastructure

Inadequate infrastructure was an important constraint to mining development in Argentina. Argentina's railway system did not reach the mining areas and the road system in the mining provinces was underdeveloped. The major industrial centers and national ports are at great distances from the mining areas, raising the cost of inputs and of marketing. Costs of power and water supply were also high. Mining companies either connected to a regional power system or installed their own power generation. Water supply was an even more serious problem than power supply, as much of the present and potential mining activity was located in arid areas. Finally, the isolated location of mining operations required the establishment of fully developed mining camps. Roads were one of the principal transport methods used to move mine production to processing plants in Buenos Aires and other shipping centers. Argentina has 11,000 km of navigable inland waterways and an excellent navigable river system. River transport operates largely on the Río de la Plata estuary and its tributaries: the Paraná, Uruguay, Paraguay, and Alto Paraná Rivers.

Argentina had about 4,090 km of pipelines to transport crude oil and 2,900 km for refined products, and 9,918 km of gas pipelines from production centers to consumer centers. The system connected oilfields and refineries to the north, center, west, and southeast with main industrial centers. The pipeline to transport crude oil from Argentina's Neuquén Basin to Concepción, Chile, across the Andean Range was not completed at yearend 1995. Natural gas was imported from Bolivia by a gas pipeline through Yacuiba-Pocitos at the border to the northern provinces and Buenos Aires. The existing Argentine railroad network, owned and operated by the state enterprise, Ferrocarriles Argentinos, covered approximately 34,000 km.

Outlook

Argentina's energy resources, which are abundant and diverse, include crude oil, natural gas, hydropower, and fair amounts of coal and uranium, with a potential not fully determined. New investments in Argentina are directed toward several promising projects including copper, gold, crude oil, natural gas, petrochemicals, and gas pipelines. Both National and provincial laws encourage the development of mining by private enterprises, including foreign companies. Several major mining companies and more than 60 junior companies are exploring the whole range of the Argentine Andean chain. Argentina's mineral resources will be important in the future of worldwide investment, development, and mineral-resource analyses.

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[1]Text prepared March 1997.

[2]Where necessary, values have been converted from Argentine pesos to U.S. dollars at the rate of 1.00 peso=S$1.00, the average exchange rate in 1995.

Major Sources of Information

Ministerio de Economía y Obras y Servicios Públicos
Hipólito Yrigoyen 250, (1310)
Buenos Aires, Argentina
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Secretaría de Minería

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Ministerio de Economía y Obras y Servicios Públicos
Julio A. Roca 651-2do (1322)
Buenos Aires, Argentina
Fax: (541) 331-4230

Publications

Estadística Minera de la República Argentina, Subsecretaría de Minería, Annual report.
Panorama Minero, Monthly magazine.

TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS						
Aluminum:						
Primary		169,000 r/	155,600 r/	170,600 r/	175,900 r/	184,100 3/
Secondary e/		6,000	6,000	6,000	6,000	6,000
Beryllium: Beryl concentrate: e/						
Gross weight		34	34	35	--	--
BeO content		3	--	--	--	--
Cadmium concentrate:						
Gross weight		118	119	80	68 r/	82
Cd content		49 e/	37	34	35 e/	35
Columbium: Columbite concentrate: e/						
Gross weight	kilograms	90	95	--	--	--
Cb_2O_5 content	do.	67	70	--	--	--
Copper: e/						
Mine output, Cu content		409 3/	300	300	300	300
Refined		12,000	15,000	15,000	15,000	15,000
Gold, mine output, Au content	kilograms	1,510	1,300 e/	937	937 r/	837
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	259	--	--	--	--
Fe content	do.	171	3	2	28 r/	--
Metal:						
Pig iron	do.	1,305	966	984 r/	998 r/	1,050
Sponge iron (direct reduction)	do.	954	1,027	1,156 r/	1,266 r/	1,360
Total	do.	2,259	1,993	2,140 r/	2,264 r/	2,410
Ferroalloys, electric-furnace:						
Ferromanganese		26,337	4,524	5,400	4,500 r/	5,000
Ferrosilicomanganese		14,564	30,790	18,500	20,000 e/	20,000
Ferrosilicon		14,437	8,073	19,579	10,000 e/	9,000
Total		55,338 r/	43,387 r/	43,479 r/	34,500 r/ e/	34,000
Steel, crude	thousand tons	2,991 r/	2,700	2,886	3,300 e/	3,617 3/
Semimanufactures 4/	do.	2,930	2,640	2,850	3,340 e/	3,670 3/
Lead:						
Mine output, Pb content		23,697	17,956	11,826	9,981 r/	10,521 3/
Metal:						
Smelter, primary e/		11,000	14,600 3/	14,600	14,600	14,000
Refined:						
Primary		10,000 e/	14,597	12,473 r/	7,785 r/	2,430 3/
Secondary		13,697	15,000 e/	16,000 r/	17,600 r/	26,298 3/
Total		23,697	29,597	28,473 r/	25,385 r/	28,728 3/
Manganese ore and concentrate:						
Gross weight		4,943	3,840	3,900	3,900 e/	4,000
Mn content e/		965 3/	750	760	760	780
Silver:						
Mine output, Ag content	kilograms	69,959	45,374	42,744	38,032 r/	47,787 3/
Metal, smelter e/	do.	109,000	107,000	108,000	108,000	110,000
Tin: Metal, smelter		240	140 e/	129	100 e/	100
Tungsten, mine output, W content		5	--	--	--	--
Uranium, mine output, U_3O_8 content	kilograms	2,100	146,000	148,000	94,000 r/	68,000 3/
Zinc:						
Mine output, Zn content		39,253	40,978	31,395	26,933 r/	32,104 3/
Metal: Smelter:						
Primary		35,800	34,500	31,000 r/	30,000 r/	31,000
Secondary e/		2,800	2,800	2,800	1,000 r/ 3/	2,000
Total		38,600	37,300	33,800 r/	31,000 r/	33,000

See footnotes at end of table.

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TABLE 1–Continued
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS						
Asbestos		270	215	309	319 r/	250
Barite		23,900	10,000	14,761 r/	27,952 r/	27,000
Boron materials, crude		116,000	125,000	146,349	215,021 r/	244,933 3/
Cement, hydraulic	thousand tons	3,399	5,051	5,647	6,306 r/	6,200
Clays:						
Ball clay (plastic clay) e/	thousand tons	80	100	100	90	90
Bentonite		107,782	97,531	96,706	117,095 r/	113,760 3/
Foundry earth		100,000 e/	90,000 e/	96,709 r/	119,179 r/	120,000
Fuller's earth (decolorizing clay) e/		2,000	1,500	1,600	1,600	1,600
Kaolin		47,115	43,722	42,052	50,471 r/	40,000
Laterite (aluminous)		21,400	63,500	-- r/	-- r/	--
Refractory e/		30,900 3/	31,000	32,000	30,000	--
Other 5/	thousand tons	2,350	2,610	2,700 e/	2,600 e/	--
Diatomite		6,130	5,360	3,096	6,260 r/	4,928 3/
Feldspar		42,300	48,500	55,764	39,825 r/	36,901 3/
Fluorspar		16,500	4,590	4,611	3,585 r/	5,071 3/
Graphite		85	20	-- r/	-- r/	--
Gypsum, crude		384,000	514,000	519,181	515,269 r/	531,735 3/
Lithium: Spodumene, amblygonite, gross weight		287	620	300 e/	400 e/	400
Mica:						
Sheet		610	373	720	720 e/	700
Waste and scrap		1,038	635	1,226	1,104 r/	4,341 3/
Nitrogen: N content of ammonia e/		75,000	72,000	72,000	73,000 r/	70,000
Phosphates: Thomas slag e/ 6/		50	50	50	50	50
Pigments, mineral, natural: Other e/		77	40	28	35	30
Pumice and related volcanic materials (perlite, pozzolan, and toba, etc.)		69,700	89,100	98,631 r/	114,082 r/	52,255 3/
Salt:						
Rock e/	thousand tons	--	--	1	3 r/	1
Solar	do.	943	952	1,030	852 r/	986 3/
Total	do.	943	952	1,031	855 r/	987 3/
Sand and gravel:						
Sand:						
Construction	do.	11,000	12,800	16,246 r/	14,327 r/	15,450 3/
Silica sand (glass sand)	do.	374	340	396	247 r/	286 3/
Gravel	do.	7,150	6,810	7,800 r/	8,157 r/	5,617 3/
Soda ash e/		300	290	300	250	200
Stone:						
Basalt	thousand tons	548	677	1,112	1,653 r/	1,879 3/
Calcareous:						
Calcite, nonoptical		7,520	13,600	34,513 r/	59,933 r/	52,577 3/
Calcium carbonate (chalk)		8,330	17,000	19,000	20,000 e/	20,000
Dolomite		402,000	353,000	434,000 r/	687,000 r/	1,083,000 3/
Limestone	thousand tons	9,240	10,800 e/	10,740 r/	11,970 r/	11,491 3/
Marble:						
Aragonite, broken		1,200	1,650	1,107	1,102	1,000
Onyx, in blocks and broken		2,520	2,920	1,701	928 r/	922 3/
Travertine, in blocks and broken		13,200	19,900	27,865	9,790 r/	18,350 3/
Unspecified, in blocks and broken		23,100	22,000 r/	24,426 r/	15,338 r/	9,760 3/
Flagstone		70,200	97,600	94,749	85,555 r/	109,791 3/
Granite:						
In blocks		53,900	53,900	87,337 r/	176,127 r/	125,487 3/
Crushed	thousand tons	4,500	5,130	5,656 r/	5,236 r/	6,835 3/
Quartz, crushed		121,000	106,000	101,399	67,936 r/	95,121 3/
Quartzite, crushed	thousand tons	538	400 e/	490 r/	618 r/	1,841 3/
Rhodochrosite		20	30 e/	58	46 r/	69 3/
Gamestone (agate, amatist, apolo, turmalin,	kilograms	43,400	30,000 e/	4,963	4,900 r/	3,134 3/
Sandstone e/		,250	240	240	230	200
Serpentine, crushed		19,900	36,800	26,518	26,816 r/	83,681 3/
Shell, marl		240,000	237,000	247,928	238,037 r/	869,650 3/
Tuff, (tosca)	thousand tons	2,330	3,280	5,148 r/	6,234 r/	7,002 3/
Strontium minerals: Celestite		1,200 e/	1,200 e/	4,806 r/	8,484 r/	9,325 3/

See footnotes at end of table.

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TABLE 1–Continued
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS–Continued						
Sulfates, natural:						
Aluminum (alum)		71,900	85,300	29,240	56 r/	352 3/
Magnesium (epsomite)		6,500 e/	6,500 e/	2,820 r/	1,160 r/	720 3/
Sodium (mirabilite)		16,100	24,800	6,554	7,978 r/	10,604 3/
Talc and related materials:						
Pyrophyllite		--	--	1,962 r/	1,996 r/	4,189 3/
Steatite		274	425	840	500 e/	300
Talc		22,800	21,200	17,200	17,350 r/	17,300
Total		23,074	21,625	20,002 r/	19,846 r/	21,789 3/
Vermiculite		190	--	38	32 r/	44 3/
Water, mineral-containing e/		140,000	140,000	140,000	130,000	135,000
Zeolite e/		90	95	90	90	90
MINERAL FUELS AND RELATED MATERIALS						
Asphalt and bitumen, natural (asphaltite)		5,850	994	160 r/	121 r/	662 3/
Coal, bituminous	thousand tons	294	212	200 e/	215 e/	210 3/
Coke, all types, including breeze e/	do.	830	820	800	200	300 3/
Gas, natural:						
Gross e/	million cubic meters	23,000 r/	18,000 r/	24,000 r/	26,000 r/	27,000
Marketed 7/	do.	17,900	19,100	21,500 r/	22,100 r/	22,000
Natural gas liquids: e/						
Butane	thousand 42-gallon barrels	4,200	3,770	3,800 3/	3,850	3,847 3/
Propane	do.	5,000	4,560 3/	4,600 3/	4,600	4,653 3/
Total	do.	9,200	8,330 3/	8,400 3/	8,450	8,500
Peat, agricultural (turba)		1,210	1,180	2,880 r/	2,932 r/	4,000 3/
Petroleum:						
Crude	thousand 42-gallon barrels	176,000 r/	203,000	213,000 r/	240,170 r/	265,000
Refinery products:						
Gasoline	do.	35,900	30,700	31,200	31,200 e/	31,740
Kerosene	do.	3,770	2,610	2,400	2,400 e/	2,700
Jet fuel	do.	6,350	4,540	4,670	4,670 e/	4,700
Distillate fuel oil	do.	61,000	48,800	48,700	48,700 e/	49,700
Lubricants	do.	1,410	1,160	1,280	1,280 e/	1,200
Residual fuel oil	do.	26,600	28,600	27,800	27,800 e/	29,530
Other	do.	13,700	17,700	17,000	17,100 e/	18,350
Refinery fuel and losses	do.	26,700	1,040	--	-- e/	1,080
Total	do.	175,430	135,150	133,050	133,150 e/	139,000

e/ Estimated. r/ Revised.

1/ Table includes data available through July 1996.

2/ In addition to the commodities listed, bismuth, carbon black, columbite, lime, natural gasoline, perlite, and potassium sulfate (kalinite) were believed to be produced b output was not reported quantitatively, and available information was inadequate to make reliable estimates of output levels.

3/ Reported figure.

4/ Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

5/ Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.

6/ Thomas slag production was estimated from the Thomas crude steel reported in La Siderurgia Argentina annual, published by the Instituto Argentina de Siderurgia.

7/ Includes natural gas imported from Bolivia.

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THE MINERAL INDUSTRY OF

BELIZE

By David B. Doan

Extraction of construction materials constitutes the principal mining activity in Belize, amounting altogether to less than 1% of the gross domestic product (GDP). Primarily a seacoast agricultural country, the sale of agricultural produce, fish, and lumber amounted to at least 30% of GDP and about 75% of export earnings. The GDP itself was approximately $575 million in 1994.

Mining activities were regulated by the Mines and Minerals Act of 1988, which did not include petroleum. Although clays, limestone, marble, and sand and gravel for construction and civil works were the mainstay of Belize's mineral production, a very small amount of gold was produced.

Prior to 1988, the nation's mineral production was largely by private companies on contract to the Government's Department of Public Works. After 1988, the Government's Geology and Petroleum Office has administered mineral permits, licenses, and concessions. Prospecting licenses for base metals, clays, and limestone were held by fewer than five foreign companies in the early 1990s. Petroleum concessions were held by several British and U.S. companies.

Belize had 500 kilometers (km) of paved roadways out of a total of 2,710 km altogether, the remainder being gravel or loose-surface roads. Truck transportation was utilized extensively.

The geology of Belize comprised younger limestones for the most part, but with an older inlier ("window") of granites, basalt or dolerite dikes, rhyolites, and sedimentary sandstones and shales, the latter showing some metamorphic alteration. The rock types would seem to represent a sufficient diversity to encourage exploration for base and precious metals. In this connection, aside from the small amount of placer gold extracted from time to time, there have been occurrences of barite and gypsum reported, as well as anomalous values for beryllium, molybdenum, and lead in stream waters.[1]

Belize will certainly realize a steadily growing demand for construction materials as the country fosters increased tourism and develops its infrastructure. Beyond this, however, is the prospect of new discoveries of base and precious metals and the realization of a greatly enhanced mineral industry in support of a growing economy.

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[1]Bateson, J.H, and Hall, I.H.S. The Geology of the Maya Mountains, Belize, Overseas Memoir 3, Institute of Geological Sciences, Her Majesty's Stationery Office, 1997.

Major Sources of Information

Geology and Petroleum Office
Ministry of Natural Resources
84-36 Unity Blvd.
Belmopan, Belize

Major Publications

Garcia, E. Mineral Resources of Belize, C.A. Transcript of presentation at the Belizean Studies Conference, Belize City, Oct. 26, 1990

TABLE 1
BELIZE: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994	1995
Clays	2,000,000	2,000,000	2,000,000	2,100,000	2,200,000
Dolomite	28,000	28,000	28,000	30,000	29,000
Gold kilograms	5	5	2	5	5
Lime	1,000	1,000	1,000	1,000	1,100
Limestone	300,000	300,000	250,000	300,000	310,000
Marl thousand tons	1,000	1,000	1,000	1,050	1,200
Sand and gravel	200,000	300,000	200,000	300,000	320,000

1/ Estimated data are rounded to three significant digits.
2/ Includes data available through May 1, 1996.

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THE MINERAL INDUSTRY OF

BOLIVIA

By Pablo Velasco

According to the National Statistical Institute, the gross domestic product (GDP) of Bolivia grew by 3.7% to $15.8 billion[2] in 1995, lower than the 4.2% growth registered in 1994. Bolivia's public debt to December 1995 totaled $4.5 billion. Export revenues increased by about 13.3% to about $1.2 billion owing to increases in the total mineral exports of gold, silver, and zinc, including crude oil and natural gas. These revenues, including petroleum and natural gas, represented about 53.5% of Bolivia's total export earnings. Gold, silver, and zinc outputs are currently the mineral base sustaining Bolivia's mineral industry.

In August, 1995, Bolivia signed a final agreement for the natural gas export project to Brazil. The pipeline construction could begin in the third quarter of 1997 with natural gas delivery by late 1998. Bolivia also signed a free trade agreement with Mexico late in 1995 and agreed to a trade agreement with the Mercosur customs union under a so-called four-plus-one formula. The formula allows for the creation of freetrade zones between the Mercosur and other countries, but it stops short of full membership in an eventual common market. The Mercosur is currently composed of Argentina, Brazil, Paraguay, and Uruguay.

Zinc became the most valuable export commodity, producing an income of about $151.4 million, an increase of 43.8% compared with that of 1994, followed by gold, which increased 9.8% to about $130.8 million over that of the previous year. Hydrocarbons continued in third place in the Bolivian export balance sheet after minerals and nontraditional goods. However, in 1995, the nontraditional export value increased about 5% to $549.5 million compared with that of 1994 and represented about 47% of the total export earnings.

The medium mining sector—the privately owned commercial mines—was the dominant producer responsible for more than one-half (57%) of the value of mine production in 1995. Value of production by Corporacion minera de Bolivia (COMIBOL), the state-owned company, in the same period, declined from 51% in 1985 to about 7% in 1995.

The Government in 1995 promulgated a number of significant legal and regulatory reforms designed to enhance the investment environment in which the capitalization process, will transfer operations to the private sector, will allow broader economic development. The reforms include the following: (1) The tax law passed by Congress on December 22, 1994, which dramatically simplifies the tax regime, establishing a single corporate income tax rate (25%) and single fixed rates for value-added and other transaction-related taxes, will apply to all private companies. Mining companies (not smelters) are subject to a minimum 2.5% departmental income tax or the corporate income tax, whichever is larger. (2) Law No. 1333, the environmental protection law approved by Congress on April 27, 1992, was enacted to establish the Government's intentions to balance the need for improved environmental protection with the imperative of sustainable economic development and to set up the air and water emission guidelines that would guide economic development activity in Bolivia. (3) The Government is nearing completion of a revision of its mining code aimed at further improving the climate for investing and operating in the country's mineral sector. Although Bolivia is widely acknowledged as having a well-developed mining code, the changes under consideration have as their objectives, among others, the following improvements: (a) Ensuring equal treatment of foreign and national entities, (b) providing maximum legal and technical protection to holders of mining rights, and (c) facilitating and motivating exploration, development and profitable exploitation efforts. Included among the revisions to the mining code are provisions that allow significantly longer leases than those available under prevailing rules.

There are two main programs related to the mineral sector: (1) Capitalization is a process by which the Government will transfer ownership and administration of six large state-owned enterprises to private shareholders. Once this process is achieved, one-half of the shares of the newly capitalized enterprises will be distributed among all adult Bolivian citizens. Once the system is reformed, shares in the capitalized companies allocated to Bolivian citizens will be transferred to their benefit through the new pension system, which will serve to motivate personal savings and the development of Bolivian capital markets. The six large public enterprises that were expected to be capitalized in 1995 included Yacimientos Petroliferos Fiscales Bolivianos (YPFB), Empresa Nacional de Telecomunicaciones, Lloyd Aéreo Boliviano, Empresa Nacional de Electricidad , Empresa Nacional de Fundiciones, and Empresa Nacional de Ferrocarriles. It was expected that investment related to capitalization

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would be equivalent to 25% of Bolivia's GDP, or about $4.0 billion. (2) The implementation of a project to export natural gas to Brazil was expected to produce annual revenues of about $230 million and was expected to attract foreign investment in oil and gas development.

Mercosur, the four-nation Latin American trade grouping, will sign an agreement giving associate membership to Bolivia despite a last minute disagreement which thretened to derail previous negotiations. Bolivia's status in Mercosur will be similar to that of Chile, reducing tariffs between Chile and the Mercosur nations to an average of 6% in 1997 and to zero over eight years.

Environmental Law No. 1333 of April 27, 1992, was created for the protection and conservation of the environment and natural resources and the regulation of human activities in order to promote and sustain development of the country while maintaining its quality of life. The objective of proposed regulations under this legislation was to follow a "best-available-technology" approach rather than a normative approach. In other words, the regime should require technology in pollution abatement, for example, in the treatment of mine water and stack effluent rather than establishing fixed contaminant levels to be achieved without regard to technology. The environmental authorities are the Ministry of Sustainable Development and Environment (Ministerio de Desarrollo Sostenible y Medio Ambiente, of Bolivia, through its Departmental Secretary of Sustainable Development and Environment at the regional or departmental level. Environmental Law No.1333 fully in forced in 1995, required that both individuals and corporations to provide information to the environmental authorities whenever their activities affect or could affect the environment and also whenever an individual accident or environmental incident took place.

The law requires both individuals and corporations to keep internal records of this information and to make it available to the authorities upon request. The Inter-American Development Bank (IDB) of Washington, DC in 1994 approved a $20 million environmental assistance loan to the Ministry of Sustainable Development of Bolivia for various activities applicable to preserving the environment in new mining and processing projects, including abandoned mined land projects. A Swedish technical mission in Bolivia completed in 1995 a preliminary report indicating a new criterion for establishment of levels and limits of permissible contamination in the mining and industrial sectors and recommended to the Government the environmental remediation of old mining sites in various parts of the country and preparing environmental audits of mining and smelting areas to follow through with backing by the IDB.

The Bolivian metals and mineral production increased substantially compared to the previous year (*See table 1.*) Crude oil and natural gas were produced by YPFB, and its contractors represented 68.3% and 31.7% of the total production, respectively. Natural gas output decreased 9.6% in 1995 compared with 5,918 milliom cubic meters (Mm^3) in 1994.

Nonfuel minerals and mineral fuels (oil and gas) continued to be Bolivia's leading exports; in combination, they contributed about 53.5% of Government revenues. Exports of nonfuel minerals in 1995 increased by 16.1% in value compared with those of 1994, to $479.1 million, amounting to less than one-half of total exports. In 1995, Bolivia continued to be a modest source of minerals for the United States. Bolivian mineral exports to the U.S. increased slightly in 1995 to $87 million. Tin export value, including metallic tin, was down 2.3% to $88.6 million. Exports of metallic tin by Vinto decreased in volume 14.5% to 13,144 metric tons (t) and decreased in value 4.6% to $80.9 million from $83 million in 1994.

In 1995, crude oil, natural gas and liquefied natural gas exports, and domestic sales contributed 33% of the national treasury's consolidated revenues. Exports of petroleum and refined products valued at $60.2 million in 1995, increased 298.4% compared with the previous year. The value of natural gas exported to Argentina increased from $91.6 million in 1994 to $92.4 million in 1995. The long-delayed hydrocarbons law was finally approved by yearend 1995, and it will be enacted on April 30, 1996, according to YPFB officials. The passage of law no. 1689 was necessary to set the stage for the capitalization of YPFB and to consolidate the natural gas export project to Brazil.

The National Secretary of Mining (NSM), a branch of the Ministry of Economic Development, is legally responsible for formulating mining policy and orienting the promotion of the sectors' development. NSM also has the function of providing investors with all of the necessary information regarding the guarantees and rights of mining concession holders, current tax laws, mining laws, and mining environmental regulations. NSM controlled and participated in the mineral industry through a renovated and more efficient state mining agency Servicio de Geología y Minería, formerly Servicio Geológico de Bolivia, the Instituto de Investigaciones Minero-Metalúrgico de Oruro, and Servicio Nacional de Información Minera. The Servicio Nacional de Catastro Minero and COMIBOL are autonomous entities.

COMIBOL's efforts continued to be centered on its privatization program in order to attract private capital to operate its mines and participate on new projects in exploration under joint ventures, leasing, or operating contracts. Until December 1995, COMIBOL had nine joint ventures and five large leasing contracts in operation. COMIBOL is also negotiating seven other large joint-venture contracts to explore/exploit known ore bodies. COMIBOL itself is not part of the capitalization program of the Government. However, COMIBOL's tin and zinc/tin mines are being offered as part of the capitalization

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program of Empresa Metalúrgica Vinto. The activities of COMIBOL will be reduced to a purely administrative role following the transfer of operating control over its properties to the private sector. Only three of COMIBOL's existing mines remained in operation in 1995: Huanuni tin mine, Colquiri tin-zinc mine, and Caracoles tin mine. The private mining sector, comprising medium- and small-scale mining entities and cooperatives, maintained its position as the leading producer of antimony, gold, lead, tin, tungsten, and zinc in the country. In 1995, the private Medium-Size Miners Association was composed of 12 affiliated mining companies, and the Small-Size Miners Association, grouped under the Cámara Nacional de Minería, included 600 small mines operating in the country. Mining cooperatives were organized under the Federación Nacional de Cooperativas Mineras and included most of the gold mining cooperatives of Gonzata, Guanay, Mapirí, and Tipuani. According to the National Institute of Cooperatives, there were more than 320 mining cooperatives in the country, grouped under the Federación Regional de Cooperativas, of which about 40% were mining gold in 1995 mainly in the Tipuani area in the Province of Larecaja, La Paz Department.

Bolivia's antimony output decreased 8.9% compared with that of 1994, amounting to 6,426 t for a total value of $18.4 million. Its production was entirely in the hands of the private sector. Approximately 67% was produced by the medium-size group of mines and 33% by the small-size group and cooperatives. Empresa Minera Unificada S.A. (EMUSA), operating its Chilcobija and Caracota Mines, remained by far the largest Bolivian antimony producer, followed by Cia. Minera Salinas S.A.

During 1995, Vinto smelted 4,337 t of antimony-in-concentrates received from Laurel Industries to produce about 3,400 t of antimony trioxide. Bolivia exported 26% of its production as antimony concentrate, 67% as antimony trioxide, and 6% as antimony alloy in 1995.

Official gold production in Bolivia increased by 13% from that of the previous year, amounting to 14.4 t for a total value of $178 million. In 1995, gold production is the second largest money earner after zinc for the country's mining industry. The success of the Kori Kollo gold and silver mine operated by Inti Raymi in the Altiplano north of Oruro has stimulated much of the recent foreign interest in the Bolivian mining sector. In 1995, the Kori Kollo Mine set a new production record with an output of 10.5 t of gold and 49.2 t of silver recovered compared to 9.7 t in 1994 and 40.7 t of silver. Orvana Minerals Corporation of Canada and EMUSA formed a joint-ventured to explore the disseminated gold prospect of San Bernardino in Challapata (Pederson Project) in the Altiplano. Orvana Minerals also purchased the copper-gold Don Mario deposit in eastern Bolivia and was concluding an intensive drilling exploration program in 1995. Da Capo Mining Company of Canada concluded its exploration program in the Amayapampa gold deposit with positive results. The richest and most productive alluvial gold deposits are located on the Challana, Kaka, Mapirí, and Tipuani Rivers, all in the northern area of the Department of La Paz. The second most important alluvial mining is in the Araras area in the northeast part of the country on the border with Brazil, where gold has been recovered from the Madera and Madre de Dios Rivers.

Production of metallic lead, including alloys, decreased by 67% from the depressed level of previous years. Output of metallic silver decreased 1.8% below that of 1994. The medium-size mining sector was the dominant lead and zinc producer, with 83% of total lead and 69% of total zinc. In this sector, the major producers were Empresa Minera Quioma S.A. COMSUR's subsidiary and La Solucion S.A. In 1995, Bolivia's zinc concentrates were smelted in Germany.

1995, tin prices remained low and consequently tin output decreased about 10% to 14,419 t from 16,027 t in 1994. Tin output amounted to 14% of the country's total 1995 mineral exports value compared with zinc exports that decreased to 30% of the total mineral exports value. The largest production increase in the private sector was by the small-size mines and cooperatives. For the ninth consecutive year, they replaced COMIBOL as the leading tin producer, which accounted for about 69% of Bolivia's tin production in 1995. The COMIBOL mines produced about 28% of the country's total mining output.

In 1995, COMIBOL signed 12 new joint-venture exploration contracts with local and foreign mining companies to explore mines and ore bodies of its own in Northern and Southern Lipez in Potosi Department. COMIBOL's Huanuni Mine became the largest and the richest tin mine in the country since its reopening in September 1988. The Vinto tin smelter (formerly operated by ENAF) smelted 37,966 t of tin ore (12% less than that of 1994) to produce 17,663 t of metallic tin. Of this, under a toll contract, Vinto smelted 11,474 t of tin ore for Minsur, S.A. and San Rafael Mine of Peru. Vinto's exports decreased to 12,915 t of metallic tin (99.93% average tin content) in 1995. About 93% of Bolivia's metallic tin exports went to the United States and the rest to six Latin American countries.

Bolivia's production of tungsten concentrate (WO_3), heavily dependent on international prices, increased to 826 t in 1995 from 583 t in 1994. Production came from the small miners and cooperatives that have small deposits with high ore grades and low labor costs. Output of the small-size mining sector increased about 42% to 583 t (WO_3 content).

During 1995, total cement produced in the country was more than 800,000 t, an increase of 33% compared with that of 1994. Cement in Bolivia was produced by four plants in different regions of the country having a total production capacity of about 870,000 metric tons per year

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(t/yr). Two plants, Fábrica National de Cementos S.A. and Fábrica de Cementos El Puente, were state-owned. Under the current Government's privatization policy, the two plants were offered for sale under an international bid. The Compañía Boliviana de Cementos S.A.M., in Irpa Irpa, Department of Cochabamba, has a production capacity of 300,000 t/yr and is a mixed-capital company (state 50% and private 50%). The Sociedad Boliviana de Cementos S.A. in Viacha, Department of La Paz, with a capacity of 300,000 t/yr, is the only wholly privately owned cement plant in the country.

In 1995, the state oil and gas company YPFB produced about 30,000 barrels per day of crude oil. In August 1995, the Government began receiving preliminary bids from investors interested in buying a share of YPFB. A total of 80 foreign and domestic firms initially expressed interest in bidding on the company. In the end, 35 companies qualified to participate in an auction for the oil conglomerate. In October 1995, the Bolivian Government announced a delay in the transfer of YPFB to private control pending review of the bidding process. Deadlines for submission of prequalification credentials were extended, with a final list of selected companies in late 1995. In January 1996, the government will unveil YPFB's latest capitalization plan. During 1995, YPFB had 17 active operational contracts (production sharing exploration contracts). Eight were with subsidiaries of U.S. oil companies, and the remainder were with other operational contracts from other foreign and domestic companies as operators. During 1995, no new contracts were signed, but YPFB continued to negotiate 11 exploration and enhanced recovery contracts with different foreign companies.

Production of natural gas decreased 9.7% from that of 1994 to 5,346 Mm^3. YPFB's Víbora Gasfield with 858.4 Mm^3 became the largest natural gas producer in 1995; its production increased 13.8% compared with that of 1994. The Carrasco's Gasfield output was YPFB's second largest natural gas producer, increasing 39.9% in 1995. Production from the new fields of Patujusal and Los Cusis increased 120.5% and 152.5%, respectively. Maxus Bolivia Inc.'s Surubi Gasfield and Pluspetrol S.A.'s Toro Gasfield increased 136.5% and 778%, respectively.

Of the total natural gas produced in Bolivia, 38.4% was exported to Argentina; 16.5% was consumed domestically; 28.6% was reinjected into the gasfields; 9.9% was vented, flared, or lost; 3.9% was consumed as fuel by YPFB; and the remaining 2.7% was converted into liquefied petroleum gas (LPG). Currently, Bolivia exports natural gas to Argentina and has major plans to export gas to Brazil, Chile, and Paraguay in the near future. Bolivia's future pipeline plans include a link to northern Chile, a pipeline to Brazil, and the Paraguayan pipeline project. The pipeline to Chile has been delayed because of a problem with the proposed route, which was found, in January 1995, to have geological faults. Additionally, the Bolivian army has refused to support the pipeline project until Chile agreed to deal with the issue of Bolivian access to the Pacific Ocean. The pipeline is eventually expected to handle as much as 20 million cibic meters per day (Mm^3/d) of natural gas as demand increases. In September 1995, Bolivia and Paraguay signed an agreement for Bolivia to supply natural gas to Paraguay through a new pipeline. The Paraguay-Bolivia pipeline would run from Vuelta Grande Gasfield in Santa Cruz, Bolivia, to Asunción, Paraguay. The Trans Chaco pipeline was 800-kilometers (km) long and could transport up to 1.4 Mm^3/d after 5 years from its initial level of 566,000 cibic meters per day m^3/d. The initial delivery of 566,000 m^3/d of natural gas was at a cost of $1.20 per million British thermal units (Btu). The Bolivia-Brazil gas pipeline is by far the most important of the projects. On August 17, 1994, Bolivia and Brazil renegotiated the 1993 contract, just before the project financing deadline. As a result of this renegotiation, an addendum to the contract was signed by YPFB and Petróleo Brasileiro, S.A. Based on recommendations made by the First Boston Consulting Group, the financial and institutional structure of the $2.0-billion-plus pipeline will comprise two major companies. One will run the $400-million, 577-km Bolivian portion of the pipeline from the Rio Grande Gasfield in Santa Cruz to Puerto Suarez. The other company will run the $1.6-billion, 1,800-km-long pipeline from the Brazilian border to Sao Paulo and beyond. Recently, YPFB and Enron Development Corp. of the United States formed a joint-venture company to construct and run the natural gas pipeline, which is scheduled to begin gas deliveries to the Brazilian cities of Sao Paulo in 1998 and Porto Alegre in 1999.

Crude oil plus lease condensates are produced by YPFB and its contractors. YPFB's production represented 68.3% and the contractors 31.7% of the country's total production in 1995. Bolivia's total liquids production increased 10.3% to 10.3 million barrels (Mbbl), or 28,349 barrel per day (bbl/d), compared with 9.3 million barrels (Mbbl) (25,703 bbl/d) produced in 1994. The country's total liquids production, including the production of LPG and natural gasoline, reached 31,083 bbl/d for 1995 compared with 28,186 bbl/d for 1994. Increases were seen in YPFB's new oilfields of Los Cusis (up 152.5%) and Patujusal (up 120.5%).

The contractor's crude oil production continued to rise and was 54.1% higher than in 1994 owing to Maxus's increased output. The Surubi Oilfield operated by Maxus Energy Corp. of the United States started production in August 1992 and has already doubled its output to 2.3 Mbbl (up 136.5%) in 1995.

The transportation network of Bolivia was composed of a total of 38,836 km of highways. The Pan-American Highway linking Argentina and Peru crossed the Country from south to northwest. The 3,684-km, Government-

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owned railroad system was controlled by Empresa Nacional de Ferrocarriles. Bolivia's 10,000 km of commercially navigable waterways connected the eastern region of the country with the Amazon basin. As a landlocked country, Bolivia had no ocean ports but had access to ports in Chile through the Arica and Antofagasta Provinces and Peru via Matarani port to international markets.

About 13.5 Mbbl of crude oil and condensates, 5.6 Mbbl of refined oil products, and 1,251 Mm^3 of natural gas were transported between major distribution centers in Bolivia through 5,980 km of pipelines owned and operated by YPFB. All the pipelines were reversible, with the exception of an export pipeline to Arica, Chile. The generation, transmission, and distribution of electrical power in Bolivia was carried out by both state and private companies. Bolivia had an installed electrical generating capacity of 756 megawatts (MW), of which 308 MW, or about 55%, was generated by hydroelectric plants and the remainder by thermoelectric plants operated by Empresa Nacional de Electricidad, that had an installed generating capacity of 468.2 MW, or 62% of Bolivia's total.

The Bolivian economy will continue to rely heavily on the hydrocarbon sector. Taxes and royalties to be paid on internal sales of finished petroleum products will remain essential revenues for the national treasury. Natural gas exports will be a valid component of Bolivia's foreign exchange earnings. On March 1994, YPFB signed a new 3-year contract with Yacimientos Petroliferos Fiscales S.A. (YPF S.A.) of Argentina to continue exporting the same volume of gas through March 1997 at an average price of $1.07 per million Btu. In August 1995, the final agreement and an annex for the natural gas export project to Brazil was signed by YPFB of Bolivia and Petrobrás of Brazil.

Through a combination of capitalization and joint venture transfer to private sector control, the Government of Bolivia intends to reduce not only its size
overall but also the role of the state in the Bolivian economy, especially in its mining sector. In support of the transfer program, the Government has enacted a series of legal, regulatory, and tax simplification measures as well as environmental law and regulations that have created a favorable and competitive foreign investment framework.

The Government of Bolivia has also signed accords with the World Bank's Multilateral Investment Guarantee Agency and with the Overseas Private Investment Corporation to provide insurance against certain political risks to foreign investors in Bolivia. Mining companies, both large and small, are involved in an increasing level of exploration activity, with some promising projects underway in 1996. Exploration was taking place in each of the four principal regions of the country: Altiplano, Cordillera, Brazilian Shield, and the Northeast. The most promising prospects are the gold properties of Escala, Cashi Laguna, and Don Mario, each with a good possibility of becoming open pit mines. COMSUR S.A.'s El Puquio Norte project also has considerable potential. The Bolivia's capitalization plan is an audacious program designed to bring to the country the benefits of privatization without turning the companies involved completely over to private investors.

Future resource development is likely to focus on continued expansion of the hydrocarbon sector, as well as the development of Bolivia's gold industry and the iron ore-steel prospects at the Mutún deposit near the Brazilian border, the development of the lithium and potassium projects from the Uyuni salt flats, the expansion of sulfur production, and the extraction of gold from alluvial deposits in La Paz and at the Brazilian border.

The Bolivia-Brazil energy integration agreement included the selling of electricity generated by a natural gas-fired thermoelectric plant; urea and high-density polyethylene from a proposed plant to be installed in Puerto Suarez, Department of Santa Cruz; and the construction of the 563-km gas pipeline between the Santa Cruz Gasfields and Puerto Suarez near the Brazilian border.

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[1]Where necessary, values have been converted from bolivianos ($b) to U.S. dollars at the rate of $b4.9 = US$1.00.

Major Source of Information

Secretaría National de Minas
Ave. 16 de Julio 1769, Casilla 8686
La Paz, Bolivia

Major Publications

Secretaría Nacional de Minería, La Paz, Bolivia:
Boletín Estadístico de Minería, monthly, annual.
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U.S.Geological Survey and Servicio Geologico de Bolivia on the "Geology and Mineral Resources of the Altiplano and Cordillera Occidental"Bulletin 1975.
Corporación Minera de Bolivia, La Paz, Bolivia: Information Memorandum for Prospective Investors.
American Embassy, La Paz, Bolivia: Bolivian Mining and Petroleum outlook, 1995-96 report.

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TABLE 1
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
METALS 3/						
Antimony:						
Mine output, Sb content		7,287	6,022	5,556	7,050	6,426
Metal including Sb content of trioxide		3,550	5,670	4,470	5,880	4,840
Arsenic, mine output, arsenic trioxide, arsenic sulfide		463	633	663	341	362
Bismuth:						
Mine output, Bi content		—	—	—	—	121
Metal, smelter		—	30	7	36 r/	19
Cadmium, mine output, Cd content 4/		115	71	4	—	— e/
Copper, mine output, Cu content		30	101	94	79	127
Gold, mine output, Au content 5/	kilograms	3,500	4,690	10,400 r/	12,838	14,405
Iron ore: 6/						
Gross weight		102,000	55,500	51,000 e/	2,600 r/ e/	— e/
Fe content		72,100	35,000	32,100	1,650 r/	— e/
Lead:						
Mine output, Pb content		20,800	20,002	21,220	19,679	20,387
Metal, smelter		213	261	537	597	195
Manganese, mine output, Mn content		215	100	—	—	— e/
Silver, mine output, Ag content 7/	kilograms	375,708 r/	282,350	332,768	352,083	425,053
Tantalum, tantalite	do.	3,740	2,720	3,535	1,820	565
Tin:						
Mine output, Sn content		16,800	16,500	18,600	16,200	14,419
Metal, smelter		14,700	14,400	14,500	15,300	17,709
Alloys		261	75	94	100 e/	248
Tungsten, mine output, W content		1,070	851	287	462	655
Zinc, mine output, Zn content		129,778	143,936	122,638	100,742	146,131
INDUSTRIAL MINERALS						
Barite		1,280	368	—	3,310	10,845
Bentonite		825	454	368	364	252
Calcite		480	500 e/	37	100 e/	20 e/
Cement, hydraulic		591,630	600,288	653,800 r/	767,953 8/	868,817 8/
Gemstone, amethyst:						
Polished	kilograms	254	3	15	33	47 e/
Rough	do.	32,100	47,200	248	220	310
Gypsum, crude e/		4,000	6,000	4,000	532 8/	1,800 8/
Marble		37	67	37	318	170
Onyx	kilograms	10,800	104	133	56	250
Pumice e/		100	100	80	50	—
Quartz	kilograms	—	100	816	400	— e/
Salt e/		255 8/	260	200	200	4,924 8/
Sandstone (arsenisca)		—	119	—	—	— e/
Slate (pizarra)		14,800	5,000 e/	163	268	280
Sodalite	kilograms	4,170	3,000 e/	—	—	— e/
Sulfur, native		2,780	15	1,050	252	— e/
Ulexite		14,200	18,131 r/	11,990 r/	10,433	6,891
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	5,432	5,522	5,593	5,918 8/	5,346 8/
Marketed	do.	2,180	2,130	2,090	2,949 8/	2,943 8/
Natural gas liquids:						
Natural gasoline	thousand 42-gallon barrels	814	915 r/	772 r/	788 8/	902 8/
Other (consumption)	do.	1,900	1,816	1,809	1,939 8/	2,447 8/
Petroleum:		p				
Crude including condensate	do.	8,090	7,752	8,116	9,381 8/	10,347 8/
Refinery products:						
Liquefied petroleum gas	do.	570	511	513	510 e/	504 8/
Gasoline	do.	3,300	3,224	3,235	3,200 e/	3,433 8/
Jet fuel	do.	683	669	741	750 e/	822 8/
Kerosene	do.	269	262	231	235 e/	223 8/
Distillate fuel oil	do.	2,830	2,848	2,635	2,600 e/	2,687 8/
Lubricants	do.	90	70	31	30 e/	56 8/
Residual fuel oil	do.	816	202	330	330 e/	400 8/
Unspecified	do.	1,220	1,933	2,000 e/	2,000 e/	2,220 8/

See footnotes at end of table.

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TABLE 1--Continued
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum--Continued:						
Refinery products--Continued:						
Refinery fuel and losses	thousand 42-gallon barrels	--	--	96	100 e/	100 8/
Total	do.	-- r/	--	96	100 e/	100 8/

e/ Estimated. r/ Revised.
1/ Table includes data available through Sept. 1996.
2/ In addition to the commodities listed, a variety of industrial minerals (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.
3/ Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.
4/ Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)
5/ Includes production of metallic gold.
6/ Data represent exports and are regarded as being equal to production.
7/ Includes production of metallic silver.
8/ Reported figure.

TABLE 2
BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Antimony		Empresa Minera Unificada S.A. (EMUSA) (private, 100%)	Caracota, Chilcobija, and Espiritu Santo Mines, Potosi Department	2.7
Do.		Cia. Minera Salinas S.A. (COMISAL) (private, 100%)	Putuma Mine, Potosi Department	1.0
Antimony trioxide		Empresa Minera Hermanos Bernal S.A. (private, 100%)	Palala smelter, Tupiza, Potosi Department	1.0
Gas	cubic meters	Yacimientos Petroliferos Fiscales Bolivianos (YPFB) (Government, 100%)	Rio Grande, Vuelta Grande, and Sirari Gasfields, Santa Cruz Department	2,472
Do.	do.	do.	San Roque, Vibora, and Yapacani Gasfields, Southern District	683
Do.	do.	do.	Cascabel, Naranjillos, Carrasco, Camiri, Monteagudo, Santa Cruz Gasfield Central, and Southern Districts	441
Do.	do.	Occidental Boliviana Inc., Tesoro Bolivia Petroleum Co. (U.S.) and Empresa Naviera	El Porvenir, La Vertiente, Gasfields, Santa Cruz Department	66,100
Gold	kilograms	Cooperatives (some with U.S. equity) (private, 100%)	Tipuani, Guanay, Mapiri, Huayta, Kaka and Teoponte Rivers, La Paz Department	2.2
Do.	do.	Empresa Inti-Raymi S.A. (private, 100%) (Battle Mountain Gold Mining Co., 85%; EMUSA, 15%)	Gold Leaching, open pit operation at La Joya, near Oruro, Oruro Department	10.5
Do.	do.	Bolivian Army's Development Corp.; 200 dredges operating in the Araras region (without legal concession)	Araras, Cachuela Esperanza gold dredging, Pando and Beni Departments	6.0
Lead		Empresa Minera Quiomа S.A. (COMSUR S.A.) (private, 100%) (formerly owned by ASARCO Incorporated of the U.S.)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	16.7
Do.		Empresa Metalurgica de Karachipampa (Government, 100%) (Autonomous subsidiary Corporacion Minera de Bolivia (COMIBOL), Lead/siler smelter (continued shutdown for lack of operating capital and shortage of ore feed	Karachipampa, Potosi Department	24.0
Petroleum	thousand 42-gallon barrels	Yacimientos Petroliferos Fiscales Bolivianos Bolivianos (YPFB) (Government, 100%)	La Peña, Vuelta Grande, Rio Grande, San Roque, and Vibora Oilfield, Santa Cruz Department	4,500
Do.	do.	Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., both U.S. companies, and other contractors (private, 100%)	Porvenir, La Vertiente, Bermejo, Caigua, and Colpa Oilfields	1,200

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TABLE 2--Continued
BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

	Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Silver	kilograms	COMIBOL, Cia. Minera de Oruro, Cia. Minera Quechisla, and Cia. Minera Potosi subsidiaries (Government, 100%)	San Jose, Bolivar, Poopo, Santa Fe, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, and Potosi Departments	99.0
Do.	do.	Cia. Minera del Sur., S.A. (COMSUR) (private, 100%) (RTZ of the United Kingdom, shareholder)	Martha, Huari, Porco, and Milluni Mines La Paz Department	130.6
Do.	do	Empresa Inti-Raymi S.A.,(Battle Mountain Gold Co. 85%, EMUSA 15%)	La Joya, near Oruro, Oruro Department	40.7
Tin		COMIBOL:, Cia. Minera de Oruro, Cia. Minera Quechisla, Cia Minera de Potosi, and Cia. Minera La Paz (Government, 100%)	Huanuni, Colquiri, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosi, and La Paz Departments	5.7
Do.		COMSUR, Barrosquira, International Mining Co., Yana Mallcu and Avicaya companies (private, 100%)	Martha, Cerro Grande, Milluni, and Berenguela tin mines	.8
Do.		Small miners and cooperatives (private, 100%)	Catavi-Siglo XX, Caracoles, Bolivar Viloco, Colquiri, and Colquechaca Mines	10.0
Tin, refined		Empresa Metalurgica de Vinto (COMIBOL's subsidiary) (Government, 100%)	Vinto, Oruro Department	14.3
Do.		Fundestano de Oruro S.A. (private, 100%)	City of Oruro, Oruro Department	.05
Do.		Cia. Metalurgica Industrial y Commercial-Hormet S.A. (private, 100%)	City of La Paz, La Paz Department	.25
Zinc		COMIBOL, Cia. Minera de Oruro, Cia. Minera Quechisla, Cia. Minera de Potsi (Government, 100%)	Santa Fe, Colquiri, San Vicente, Tatasi, Animas-Inocente and Unificada Mines at Oruro, Potosi, and La Paz Departments	8.3
Do.		COMSUR, Maragua Ltda., Caballo Blanco S.A. (private, 100%)	Porco, Asientos, Maragua, Huari-Huari Monserrate,and Monte Blanco Mines at Cochabamba, Oruro, and Potosi Departments	98.5

TABLE 3
BOLIVIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1995

(Metric tons unless otherwise specified)

Commodity		Reserves
Antimony, metal content		350,000
Lead, metal content		25,965
Lithium carbonate	thousand metric tons	5,500
Natural gas	trillion cubic meters	5.85
Petroleum	million 42-gallon barrels	134.93
Silver, metal content	thousand metric tons	29,970
Tin, metal content		448,358
Tungsten, metal content		53,000
Zinc, metal content		935,497
Iron, metal content	thousand metric tons	121,223

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THE MINERAL INDUSTRY OF

BRAZIL

By Alfredo C. Gurmendi

During 1995, Brazil produced bauxite, columbium, gemstones, gold, iron ore, kaolin, manganese, tantalum, and tin from world-class deposits and exported them to the global marketplace. In Latin America, particularly within the Southern Cone Common Market (MERCOSUR), Brazil continued to be the leading producer of aluminum, cement, ferroalloys, gold, iron ore, manganese, steel, and tin. The country continued with an ambitious petroleum exploration program to expand reserves and reduce its dependence on oil imports, which satisfied approximately 60% of its crude oil requirements during 1995.

In 1995, Brazil a population of nearly 170 million and a gross domestic product (GDP) of $677 billion.[1] GDP growth decreased to 4.2% in 1995, compared to 5.7% in 1994. Foreign exchange reserves were about $52 billion. Its tremendous identified and undiscovered natural resources helped make it one of the most dynamic markets in the world, ranking ninth in the global economy and constituting one-third of the Latin American economy.

Brazil, the largest debtor Nation in the developing world, according to J. P. Morgan, completed an agreement with its creditor banks to reduce its $49-billion foreign debt with lower interest rates and longer-term loans. This accord was crucial to Brazil's efforts to liberalize further its economy, attract more foreign investment, and stabilize prices. Brazil's total debt burden, including loans from banks and from other governments, amounted to $135 billion at yearend 1995.

The Government continued to utilize tight monetary policy and high interest rates (29% for 1995) with the objective of curbing inflation from the current 22% per year to 15%, preventing price explosion and indicating, in part, a successful "Plano Real." It is the Brazilian Government's stabilization plan introduced in mid-1994, which succeeded in restraining Brazil's chronically high inflation (5,000% for 1993).

Government Policies and Programs

In 1995, the Brazilian Congress approved constitutional amendments allowing the participation of the private sector (domestic and foreign) via privatization, joint ventures, and deregulating investment in the sectors of mining, petroleum exploration, natural gas distribution, coastal and river shipping, and telecommunications. Significant measures were undertaken by the Brazilian Government; the maximum Brazilian tariff was set at 20%, compared to 42% in 1993 (the commonly applied tariff is 14%); the elimination of governmental red tape affecting trade; an Industrial Products Tax, a Federal tax levied on most domestic and imported manufactured products, was set between 0% and 15%; and the allowance of 100% of equity ownership via privatization and expatriation of profits. These actions were undertaken by the Government to create a favorable and positive environment to attract domestic and foreign investments equally.

Privatization of State-owned firms led to lower employment levels and more efficiency. Since yearend 1991, the State has sold 30 companies worth $5.25 billion, mostly in the chemical, fertilizer, and steel sectors. Another $13 billion is expected from the remaining 35 corporations of the first phase of Brazil's privatization process. Sales of Government minority holdings would provide an additional $2.5 billion. The auctioning of the large State-owned mining, telephone, and energy corporations could bring in an additional $25 billion, bringing a total revenue of about $45 billion. The realization of this revenue, however, would need the removal of all trade barriers and a constitutional ruling to privatize Brazil's monopolies in the mining, telecommunication, and energy sectors. The Brazilian Congress was also considering to provide concessions for public utilities as an alternative to privatization, and construction and management of railroads, ports, and hydroelectric powerplants in joint ventures with the private sector.

The Brazilian Congress supported the Government's economic plan for stabilization "Plano Real," based on strict control of the domestic deficit, issuance of a new currency, stable foreign exchange rates, renegotiation of its foreign debt on favorable terms, and reduction of tariffs. Also, Brazil is reviewing its 1988 Constitution by both houses of Congress, which emphasizes in creation of economic opportunities for the private sector through privatization, deregulation, and removal of impediments to competition. The telecommunications and petroleum sectors were constitutionally mandated Federal monopolies. The Brazilian Congress, in 1995, approved constitutional amendments that will open these sectors to private participation. The state-owned mining giant, Companhia Vale do Rio Doce (CVRD) is scheduled for its privatization in early 1997. In the mining sector, restrictions to foreign investments were removed in August

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1995, which means that foreign corporations are allowed to mine Brazil's minerals; however, ramifications of the constitutional reviews are unknown, which would depend on implementing legislation that had not yet been approved. Furthermore, the concessions law also passed in 1995 should create additional opportunities for the private sector in public utilities previously reserved for the State. Today, the establishment of joint ventures is a common practice in Brazil.

The country's mining industry appeared to be on the verge of an investment boom in exploration and mine development, particularly in gold. The Government's aggressive economic policies, Brazil's diversified minerals endowment, and skilled manpower base stimulated a return of the major international mining companies to Brazil. Several of them, which fled Brazil after the promulgation of the 1988 Constitution, began acquiring exploration properties and mining prospects, particularly for gold. There were over 40 companies active in Brazil that included: Barrick Gold and Newmont of the United States, Placer Dome, INCO Limited, and TVX Gold Inc. of Canada, Anglo-American and General Mining Union Corp. Ltd. (GENCOR) of South Africa, Rio Tinto Zinc Mineração Ltd. (RTZ) of the United Kingdom, and BHP Minerals and Western Mining Company of Australia.

The four MERCOSUR nations, Argentina, Brazil, Paraguay, and Uruguay implemented the MERCOSUR common external tariff on January 1, 1995, which ranges between 0% and 20% for minerals. When fully implemented, the treaty would allow unrestricted movement of labor, goods, and services among the four countries. Already, MERCOSUR has had its impact on the Latin intraregional trade, which has increased from $7 billion in 1983 to about $30 billion this year. Internal MERCOSUR trade amounted to $15 billion and mineral trade amounted to $3.5 billion in 1995.

Environmental Issues

According to the National Environmental Council, Conselho Nacional de Meio Ambiente, an environmental license was required for all mining activities in Brazil. In 1986, Law No. 88351 established the National System for the Environment, composed of representatives of the Federal, State, and local governments and private foundations involved in environmental protection and improvement.

The 1988 Constitution, Article 225, stipulated that mining operators reclaim areas environmentally degraded. Later detailed legislation which was passed with a goal of harmonizing mining activities with the environment, included the Plan for Recovery of Degraded Areas and the Environmental Control Plan. In February 1989, the President of Brazil signed a decree prohibiting the use of mercury and cyanide in the mining of gold unless approved by Brazilian State environmental agencies. The States most affected were those in the Pantanal and Amazon regions.

Resolution 010 of December 6, 1990, dictated that all mining operations required environmental licenses leading to the granting of mineral rights by the National Department of Mineral Production or Departamento Nacional da Produção Mineral (DNPM). As environmental problems increased, antipollution measures were enacted to eliminate the sources of pollutants and mitigate their effects on the environment.

Production

The total value of minerals produced in 1995 was about $13 billion, or almost 2% of GDP. Crude oil and natural gas amounted to almost $6 billion. Brazilian minerals production increased approximately 3.1% over that of 1994, caused mostly by an iron ore output increase of about 10.7%. Increases also were recorded in production of chromium, 17.4%; manganese, 13.8%; kaolin, 4.9%; and to a lesser extent asbestos, phosphate, and zinc. Gold production increased by almost 3%, however, depletion of shallow gold deposits and environmental constraints on *garimpeiros* would affect future output. *(See table 1.)*

Trade

Brazil's trade balance decreased from a surplus of $10.5 billion in 1994 to a deficit of $3.1 billion in 1995. The total value of exports was approximately $46.5 billion versus the total value of imports of $49.6 billion. During 1995, Brazil sold 13% of its exports to the other MERCOSUR members and 8% to the other countries in South America. Brazilian mineral imports were valued at $4.5 billion, while its total exports were $2.8 billion or about 1.2% below the 1994 mineral exports. The negative trade balance in the minerals sector for 1995 was heavily influenced by the value ($2.5 billion) of petroleum imports and the decrease in prices of nonferrous metals. In addition to petroleum, other major mineral imports were coal, copper, lead, natural gas, potash, sulfur, and zinc.

During 1995, Brazilian exports of steel were 12.3 million metric tons (Mt), down from 13.6 Mt in 1994. Exports of steel, mostly semifinished products, were valued at $3.9 billion, an increase of about $200 million from 1994. Imports of steel products amounted to about 193,900 metric tons (t) at a value of $211 million, representing an increase from 177,900 t valued at $208 million in 1994.

Structure of the Mineral Industry

The major portion of the mineral industry of Brazil was partially or wholly owned by private Brazilian investors, Brazilian corporations, and foreign companies in 1995. The few exceptions were the natural gas and petroleum industries, which were 100% Government owned through Petróleo Brasileiro, S.A. (PETROBRAS). In 1995,

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PETROBRAS comprised of four subsidiaries: (1) Petrobrás Distribuidora, S.A., the petroleum products distribution company; (2) Petrobrás Química, S.A., the petrochemical company; (3) Petrobrás Internacional, S.A. (BRASPETRO), the foreign operating company; and (4) Petrobrás Fertilizantes, S.A., the agricultural fertilizer company. PETROBRAS is the domestic operator. The Government privatized its steel industry, beginning in 1991, when it sold 75% of the common stock in Brazil's second largest steel mill, Usinas Siderúrgicas de Minas Gerais, S. A. (USIMINAS), to a variety of stockholders for $1.2 billion. The share auction for Cía. Siderúrgica do Nordeste took place in 1991, and specialty steelmaker Aços Finos Piratini, S.A. was auctioned in 1992. Additional mills were privatized: Cía. Siderúrgica de Tubarao (CST), a slab producer, in March 1992; Aços Minas Gerais, S.A. (ACOMINAS), a structural and rail producer, in mid-1992; Cía. Siderúrgica Nacional (CSN), Brazil's largest mill, the second half of 1992; and Cía. Siderúrgica Paulista (COSIPA), a carbon steelsheet and plate producer, was sold the first half of 1993. CVRD, the huge mining conglomerate, is 51% Government owned. There are several smaller companies engaged in the mineral industry that are partially or wholly Government owned.

The mineral industry of Brazil is large by world standards. In 1995, there were 42 cement companies operating 51 cement plants and 7 grinding plants with a clinker capacity of 36.6 Mt and an utilization rate of 70%. In the same year, there were 34 separate iron ore mining companies operating 80 mines.

The five major integrated steelworks (ACOMINAS, CSN, COSIPA, CST, and USIMINAS) produced about 17.5 Mt of the total Brazilian steel production of 25.2 Mt during 1995. CVRD produced about 62.6% of the iron ore. Mineração Río do Norte, S.A. (MRN), which is majority privately owned, produced approximately 75% of the total bauxite production, which amounted to about 11.4 Mt. The five major aluminum smelters, all predominantly private Brazilian or foreign owned, produced approximately 87% of the primary aluminum production of 1.18 Mt in 1995.

Brazil's total labor force was nearly 60 million in 1995. Of the total, services represented 42%; agriculture 31%; and industry, 27%. The minerals sector comprised approximately 4% (650,000) of the industry total of 16 million. This did not include the 500,000 to 1 million *garimpeiros* (small-scale independent miners) active in Brazil. Employment in the mining sector continued its downward trend in 1995 as Brazil's economy was affected by privatization, particularly of the steel sector. *(See table 2.)*

Commodity Review

Metals

Alumina, Aluminum, and Bauxite.—In 1995, primary aluminum production amounted to 1.18 Mt of metal, which remained near at the same level as in 1994, and bauxite production increased by about 30%, from 8.67 Mt in 1994 to 11.4 Mt in 1995. Alumina production remained at the same level of 1994, or 1.87 Mt.

CVRD constructed a 1.1 million metric tons per year (Mt/yr) alumina refinery near Paragominas, Pará, to process the bauxite from the 850-Mt deposit there. It is known as the Jabuti Project at a cost of $875 million and is scheduled to enter into full production in 1997. The startup of Jabuti was in October 1995, and produced 250,000 t of alumina. In 1995, the production capacity of primary aluminum was 1.224 Mt. About 25% of primary aluminum was produced by Albras-Aluminio Brasileiro S. A., a joint venture of CVRD (51%) and Japan's Nippon Amazon Aluminum Corp. (49%). ALCOA Mineração S.A. accounted for 24% of total primary aluminum output. Other producers included Billiton Metais S.A. with 18.1%, Compahnia Brasileira de Alumínio with 17.9%, Alumínio Poços de Caldas S.A. with 10%, and Vale do Rio Doce Aluminio S.A. (ALUVALE) with 0.5%. Valesul Alumínio, S.A. a joint venture of ALUVALE (49.7%), Billiton Metais (41.5%), and Companhia Força e Luz Cataguazes (8.8%), produced 92,600 t.

Mineração Rio do Norte, S.A. (MRN), the world's third largest bauxite producer and exporter, increased its production during 1995 by about 17.8% to 8.6 Mt compared with 7.3 Mt in 1994. MRN was planning to invest $80 million to open a new mine with 800 Mt of bauxite reserves in Trombetas, Pará, in 1997, with a capacity of 2 Mt/yr; thus, MRN's total bauxite production capacity will increase from 8 to 10 Mt/yr.

Reynolds Internacional do Brasil (Reynolds, 42.5%; Bradesco Bank, 42.5%; and J. P. Morgan, 15%) is building its third plant to produce additional 1.5 million aluminum cans, reaching a total capacity of 5.4 million cans per year. Alto Brazil Mineração is a joint venture of Alcoa Aluminio, S.A. (60%) and Billiton Metais S.A. (40%) set up to mine their bauxite deposit in the Amazon region. It proposed to mine the Oriximina deposit near the Trombetas River and MRN's bauxite mine in Pará. When in operation, it will supply the feed to the Alcoa Aluminio, S.A. refinery at São Luís, Maranhão. The Brazilian exports of primary aluminum was 800,654 t valued at about $1.5 billion.

Columbium (Niobium) and Tantalum.—Brazil was the world's most significant producer and main supplier of columbium to global markets. In 1995, Brazil produced about 83% of the world's total with approximately 23,890 t of Cb_2O_5 concentrate; 24,000 t of columbium alloys; and 1,000 t of columbium oxides. Brazil's most important columbium plant [23,000 metric tons per year (t/yr) capacity] was in Araxá, Minas Gerais, operated by the Brazilian Metallurgy and Mining Co.-Cía. Brasileira de Metalurgia e Mineração CBMM). CBMM is owned by

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Moreira Salles Group of Brazil, 55%; and Molycorp Inc. of the U.S.A., 45%. CBMM accounted for approximately 80% of Brazil's production capacity and supplied approximately 65% of the world demand for ferrocolumbium. Columbium also was produced at the Chapadão plant (3,000 t/yr capacity), in Ouvidor, Goiás, owned by Mineração Catalao, a subsidiary of Anglo American Group of South Africa.

Araxá and Catalão contained 4.5 billion tons of pyrochlore reserves by yearend. Early in the year, the Mining Resources and Research Co. of Amazonas announced the discovery of what may be the largest columbium-bearing deposit in the world. It was found in the São Gabriel da Coxoeira, Amazonas, and contains approximately 2.9 billion tons of columbium ore.

Tantalum production in Brazil was 50 t in 1995. The Araxá deposit, considered to be the world's largest and the most economically viable ore body, contains columbite and tantalite. Over the long run, the upward trend in production forecast continued in response to increased world demand for tantalum, but Brazil continued to import tantalum oxide and metal products.

Copper.—Brazilian copper concentrate production amounted to 49,000 t of metal in 1995, an increase of 23% over that of 1994 production. Total primary copper metal production amounted to 165,000 t, which was produced by Caraíba Metais from the Caraíba deposit in Jaguari, Bahia (89.9%), and the Brazilian Copper Co.'s operations in Camaquã, Rio Grande do Sul (10.1%). Caraíba Metais was acquired by the Paranapanema Group, headed by Previ of "Banco do Brasil." CVRD and its partner, Mineração Morro Velho, S.A. (MMV), a company controlled by the South African group Anglo American (50%) and the Brazilian group Bozano Simonsen (50%), concluded feasibility studies for the Salobo deposit in Carajás, Pará, proving 1.2 billion tons of reserves having a grade of 0.84% copper with associated gold, molybdenum, and silver. Production is planned at the rate of 200,000 t/yr of refined copper over a 33-year life. The expected production of gold and silver is about 8 t/yr and 27 t/yr, respectively. CVRD announced plans to build a $345 million, 225,000-t/yr copper refinery near its Salobo Mine. The estimated investment for this operation will be $1.5 billion and it was expected to go on-line sometime in 1998. This would make Brazil self-sufficient in copper production.

Copper-consuming companies in Brazil imported 159,562 t of copper in 1995. Exports were 74,019 t, of which 59,229 t was primary metal; 14,557 t semifinished; and 239 t was in other forms. In 1995, Brazil's metallic copper production was used primarily in construction and in automobile manufacturing. There also was a copper trade balance deficit of $166.6 million, the largest one among the nonferrous metals in Brazil.

Gold.—Gold production in 1995 was reported at 72 t, which represented 42 t from mining companies and 30 t from *garimpos* (cooperatives of *garimpeiros*.) The increase in gold production from the *non-garimpo* sector was due to the favorable operations at CVRD's gold mines in Minas Gerais, Bahía, and Pará, which produced 16.3 t. The second largest producer of gold in Brazil was Mineração Morro Vehlo S. A. (MMV, owned by Anglo American and Bozano Simonsen) with almost 12.3 t. Rio Paracatu Mineração, a British concern (RTZ) associated with TVX Gold of Canada, produced 5.5 t from its Paracatu Mine in Minas Gerais.

São Bento Mineração, S.A. produced 3 t of gold at its Santa Barbara Mine in east-central Minas Gerais State. Gold was extracted by a combination of pressure oxidation and bioleaching using the South African General Mining Union Corp. Ltd.'s technology. Mineração Santa Elina operated its São Vicenete Mine in Mato Grosso, producing 1.3 t of gold. This mine will be expanded to produce about 10 t of gold by the end of this decade.

Brazilian gold production could increase significantly in the near future because of increased interest by domestic and foreign investors in large unexplored areas having gold mineralization. According to DNPM, more than 2,000 gold deposits are known, mostly Precambrian vein deposits and alluvial placers.

Iron and Steel.—***Ferroalloys.***—In 1995, ferroalloy production decreased to 1,147,000 t from that of 1994 (1,344,005 t). For the year, exports decreased from those of 1994 but reached 342,424 t. In 1995, Brazil was the third largest ferroalloy producer in the world and the third largest exporter. Apparent domestic consumption was approximately 742,000 t.

Norway's Elkem A/S, one of the world's largest manganese alloy producers, formed a joint venture with Brazil's Prometal Produtos Metalúrgicos, S.A. to produce 500,000 t of ferromanganese alloy during 1996. The project is in Marabá, Pará State, in which Elkem will hold a 40% share. The manganese will come from a nearby Prometal Mine, and the iron ore will come from the Carajás District.

Nova Era Silicon S. A., where CVRD (49%) is associated with Japanese capital: Mitsubishi (25.5%) and Kawasaki Steel (25.5%), is building a silicon ferroalloy plant in Nova Era, Minas Gerais State, with an installed capacity of 48,000 t/yr. About two-thirds of output will be exported, mainly to Japan by early 1996.

Iron Ore.—Brazil's 1995 production of iron ore, reportedly 186 Mt, increased by 10% over that of 1994's 168 Mt. About 80% of that production was from the six major mining companies, in order of descending output, CVRD with 92.3 Mt; Minerações Brasileiras Reunidas S/A (MBR), 28 Mt; S.A. Mineração da Trindade (SAMITRI), 10.9 Mt; Ferteco Mineração, S.A., 9.7 Mt; and Samarco Mineração, S.A. (SAMARCO), 9.5 Mt.

The total iron ore exports for 1995 were about 131 Mt, which represented an increase of almost 12% compared

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with 1994; total export revenues increased from $2.3 billion in 1994 to $2.5 billion in 1995. The Brazilian exports were shipped to 35 countries in 1995. The major importers of Brazilian iron ore were Japan (25%) and Germany (15%). In 1995, the United States imported 8% of Brazil's total iron ore exports. The commercial products sold were: sinter-feed and pellet-feed, 70.3%; pellets, 21.4%; and lump ore, 8.3%.

CVRD started the construction of the Kobrasco pellet plant, its seventh, which is a joint venture with Pohan Iron and Steel Co. (POSCO) of the Republic of Korea. The facility is in the port of Tubarão, Espírito Santo; CVRD-POSCO plan to invest $200 million by yearend 1996 to produce 4 Mt/yr of pellets. MBR, Brazil's second largest iron ore producer, continued its long range plans to invest $1 billion during a 10-year period beginning in 1991. The investment program is aimed at increasing reserves and production. The target is to increase output to 32 Mt/yr from the present 23 Mt/yr by the end of the decade.

SAMARCO, controlled by BHP-Utah (49%) and SAMITRI (51%), started the construction of its second pellet plant at Ponta do Ubo in Espírito Santo, where annual capacity was being increased from 5.5 Mt to 11 Mt at a cost of $230 million.

Pig Iron.—Brazil produced 25.2 Mt of pig iron, which was 5.4% higher than that of 1994, and exported 2.5 Mt valued at $287 million; approximately one-third of the pig iron traded in the world. The Brazilian environmental laws stipulated that by 1995 a minimum of 50% of the charcoal used in pig iron production had to come from reforested areas rather than the virgin forests. A maximum of 20% of the charcoal usage was allowed to be purchased from third parties. It also was stipulated that the percentage of charcoal used by the pig iron producers from their own reforestation programs must reach 100% by 1997.

Steel.—Brazil's 1995 steel production totaled 25.1 Mt, which decreased by 680,000 t in comparison to 1994, placing the country eighth in world ranking. The major recipients of Brazil's exports were Asia, 5 Mt; Latin America, 2 Mt; and the United States, 1.4 Mt. The Instituto Brasileiro de Siderurgia (IBS) stressed that the Brazilian steel industry no longer received subsidies or enjoyed tariff protection that it once had and that the industry became more efficient than ever because of the major changes it has made via privatization.

Privatization has fundamentally changed the Brazilian steel industry, both in efficiency and in reduced employment levels. Vertical integration was evident as suppliers and customers of the steel companies participated in the auctions. For instance, CVRD acquired significant minority holdings in CST, CSN, and USIMINAS. CVRD supplied iron ore to these companies and continued providing them with railroad, port, and shipping facilities.

After the Government's privatization program identified Brazil's steel industry as one of the first sectors for auction, via the stock exchanges of Rio de Janeiro and São Paulo, the state-owned steel companies have been largely privatized. The last companies sold during 1994-95 were COSIPA and AÇOMINAS. The decline in employment in the steel industry from 174,000 in 1989 to 102,300 in 1995 reflected, in part, the effects of privatization and associated downsizing. State-owned companies, expecting to be privatized, reduced employment levels in anticipation of the process.

Manganese.—Brazilian production of manganese ore in 1995 was 2.39 Mt, which was 3% higher than that of 1994. CVRD continued operating its high-grade manganese mine, Igarapé Azul, in the Carajás complex. It reported production of 1.27 Mt, a large increase from 512,000 t in 1994. Indústria e Comércio de Minério S. A. controlled by the Caemi Mineração e Metalurgia group, was the second largest Brazilian producer with 290,000 t. In 1995, other manganese ore producers were: Mineração Buritirama, a subsidiary of Prometal Produtos Metalurgicos S.A., 280,000 t; Urucum Mineração S.A., 210,000 t; Sociedade Mineira de Mineração Ltda., controlled by CVRD, 150,000 t; and SAMITRI, 10,000 t.

Tin.—In 1995, Brazil was the world's third largest tin producer following China and Indonesia. Tin production has decreased from the peak of 50,200 t in 1989 to 26,175 t in 1994 and to 22,370 t in 1995 . The reduction in Brazilian output was attributed to the closing of some high-cost operations, decrease in the ore grades, and the decline in tin prices. In 1995, production cuts were made at the Pitinga Mine in Amazonas, operated by the world's largest tin firm, Paranapanema, and at the *garimpeiros'* Bom Futuro operations in Rondônia. Brazilian tin exports in 1995 declined to 10,190 t, much below the 20,185 t quota based on Brazil's commitment with the Association of Tin Producing Countries.

Paranapanema, S.A. Mineração, Industría e Construção, Brazil's largest tin-mining company, reported that its tin output was 10,150 t from its high-grade Pitinga Mine, with byproducts of columbium, tantalum, zirconium, hafnium, thorium, and cryolite, in order of importance. *Garimpeiros* produced 5,200 t and continued smuggling tin ore to Bolivia. Empresa Brasileira de Estanho, S.A., 49.7%; Paranapanema and a pool of Brazilian tin mining companies, 50.3%) produced 5,660 t from its Bom Futuro tin mine.

Industrial Minerals

Asbestos.—Economically significant asbestos deposits were in Minaçu, Goiás. In 1995, Sociedade Anônima Mineração de Amianto (SAMA) produced 3.95 Mt of chrysotile ore and 208,000 t of asbestos fiber, which was 8.3% higher than that of 1994 output (192,050 t). About 80% of Brazil's asbestos output was consumed in the manufacture of specialized cement products such as ceiling tiles, protective screens, water and sewer pipes, water

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tanks, and molded electrical insulators. Other uses were in thermal insulators, paper and cardboard, decorations, slabs, insecticide, asphalt for highways and airport runways, and the automobile industry.

Brazil exported about 35,000 t worth $29 million. Exports went mainly, in order, of importance, to India, Thailand, Japan, Nigeria, Angola, Mexico, Chile, Colombia, Uruguay, Argentina, and Saudi Arabia. Domestic consumption was increasing steadily in recent years. São Paulo was the country's largest consumer, followed by Paraná and Rio Grande do Sul. Asbestos mining and consumption have been highly regulated in most industrialized nations, forcing them to reduce both production and consumption. Industry experts expected asbestos use in the industrial nations to continue to decline through the turn of the century. In contrast, the world's developing nations were expected to greatly increase their collective asbestos consumption.

Brazilian asbestos reserves have been considered to be adequate to meet demand in the short to medium term, while SAMA was recently investing in an exploration program to assure a long term supply. In 1995, the average grade of ore from the Cana Brava Mine in Minaçu, Goiás, was 5.235% and its reserves, considering its fiber content only, was 5.86 Mt, which at a production rate of 200,000 t/yr represented a 29-year mine life.

Kaolin.—In 1995, Brazil produced about 1,000,000 t, which was almost 5% higher than that of 1994. Caulim da Amazônia S.A. (CADAM) continued operating its Adam Mine in Rio Jarí, Amazonas, and accounted for about 62% of the country's total output. Brazilian kaolin exports in 1995 amounted to 576,463 t valued at about $57 million; of this total CADAM exported 82%, or about 473,000 t.

In Brazil, kaolin was mainly used in the paper and ceramics industries. To a lesser degree, it was utilized in the manufacture of rubber, plastics, pesticides, animal feed, food supplements and pharmaceuticals, fertilizers, paint, and many other applications. Brazil had 1.7 billion tons of kaolin reserves, or about 14.2% of the world's total.

Cement.—In 1995, Brazil produced 25.5 million tons, which was almost 2% higher than that of 1994's output. Minas Gerais contributed 24%; São Paulo, 20%; Paraná, 9%; Rio de Janeiro, 8%; and other states, 39%. The domestic production of cement was expected to remain about 25 Mt/yr, unless slowdowns in civil construction are avoided and investments in the sector are augmented.

Most of the exported cement, 150,000 t, went to the MERCOSUR country members. Argentina imported 16%; Paraguay, 32%; and Uruguay, 6%; the remainder was exported to Bolivia and Peru, 32% and 7%, respectively.

Brazil imported about 260,000 t of cement from Greece, 56%; Venezuela, 11%; Cuba, 10%; Turkey, 8%; and also from France, the United Kingdom, and the United States.

Graphite.—Historically, Brazil's beneficiated natural graphite output had been centered in Minas Gerais. "Nacional de Grafite Ltda. (NGL)" mined natural graphite in the municipalities of Pedra Azul, Itapecerica, and São Francisco de Paula, which amounted to about 35,965 t grading 14% of carbon in 1995. This mine output was concentrated by NGL in products that ranged in grade from 61% to 99.5% carbon. Also in Minas Gerais in 1995 "Empresa de Mineração J. Mendes" produced 2,735 t of graphite with an average grade of 14% that was sold, domestically, after simple grinding.

There were three types of beneficiated products processed by NGL in Itapecerica and Pedra Azul: lump graphite, medium grained graphite, and graphite fines. In 1995, Brazil's demand for natural flake type crystalline graphite was met by Pedra Azul and Itapecerica beneficiation plants, which had installed capacities of 30,000 t/yr and 4,500 t/yr, respectively.

In 1995, about 370 t of graphite was imported, which was valued at $237,000, and exports amounted to 3,693 t valued at about $2.3 million.

Growth of the Brazilian apparent consumption of natural graphite, during the 1980's and 1990's, indicates a relative stability of the iron and steel sectors, which absorbed about 80% of the natural graphite consumed domestically. Other consumers included: battery manufacturing, 6.5%; refractories, 6%; paint and varnishes, 2%; and other miscellaneous uses. These trends were expected to continue into the next decade because of the healthy Brazilian steel industry.

Magnesite.—The most important magnesite mine in Brazil was Pedra Preta Mine owned and operated by "Magnesita S.A. (MSA)" in the Éguas mountain region of Brumado, Bahia, about 610 kilometers (km) from Salvador. In 1995, MSA produced 282,000 t of magnesite of which 15,076 t valued at $21.9 million was exported.

In Brazil, there were about 630 Mt of measured and indicated magnesite reserves with 180 Mt of magnesium content by yearend. It was expected that in the next decade MSA's beneficiation plant in Brumado, Bahia, and its industrial complex in Contagem, Minas Gerais, where a range of refractory materials are produced, should continue operating.

Gemstones.—For many years, Brazil has been an important world producer and exporter of gemstones. This importance has applied in terms of volume as well as variety. The large proportion of gemstones produced was mined by *garimpeiros*. For this reason, gemstone reserves are unknown, but Brazil appears to have high potential.

In 1995, the total value of gemstone (including diamond) production was $117 million, which remained at the same level as that of 1994. Exports of uncut gemstones have declined from $20.2 million in 1993 to $3.3 million in 1995 despite the removal of some export barriers.

Phosphate Rock.—Production of phosphate rock concentrate amounted to 3.6 Mt, a decrease of 8.8% from

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the previous year. Production was highly concentrated in four mining companies, Fertilizantes Fosfatados, S.A. (FOSFERTIL), 37%; Arafertil, S.A. (ARAFERTIL), 16%; Goiasfertil, S.A. (GOIASFERTIL), 16%; and Copebrás controlled by Mineração Morro Velho, a subsidiary of the Anglo American Group, 13.5%, representing 82% of the total domestic output. Copebrás began to build a fertilizer plant at 150,000 t/yr capacity near its Catalão Mine in Goías, which represents a freight reduction of $50 per ton of phosphate rock. The reported domestic consumption was 4.4 Mt/yr.

Seventy-three percent of the phosphoric acid was used in the fertilizer industry, 25% in the chemical industry, and the rest in other uses. The industry has changed because of the privatization process and elimination of trade barriers; the Government has privatized ARAFERTIL, GOIASFERTIL, and FOSFERTIL.

Quartz.—Telequartz Exp. Ltda. and others continued producing quartz powder, which is an important constituent in the production of optic fibers, crucibles, oscillators, solar cells, wafers and integrated circuit packing, and ceramic materials of exceptional purity.

In 1995, Brazil produced 5,586 t valued at about $7.4 million, and continued to be the largest producer of quartz in the world. Quartz exports were 5,549 t, valued at about $10.7 million, and were shipped mostly to Japan, 45.9%; the United Kingdom, 21.9%; Germany, 20.9%; Hong Kong, 7.8%; and others, 3.5%. Brazil is estimated to have 53 Mt of reserves.

Other Industrial Minerals.—Potassium production in 1995 increased by 5.2% to 242,300 t compared with 1994 output. Brazil imported 44,000 t of potash in 1995, mainly from Russia, 31.2%; Canada, 26.9%; Germany, 20%; and Israel, 15.7%.

Mineral Fuels

According to the Brazilian Ministry of Mines and Energy, the total amount of energy produced was 163.9 Mt of oil equivalent in 1995. The primary sources, in order of importance, were hydraulic energy, firewood, petroleum, sugarcane bagasse, natural gas, steam coal, metallurgical coal, and uranium. Imported energy sources were 61.1 Mt of oil equivalent. Total energy consumption was 178.2 Mt of oil equivalent. Export, variations in inventory, non-utilized, and reinjected energy totaled 9.6 Mt of oil equivalent. The transportation sector consumed 36.1 Mt of oil equivalent and the industrial sector 78.4 Mt of oil equivalent. Consumption, in the mineral industry, by category and in order of importance, was pig iron and steel, 19.9 Mt of oil equivalent; nonferrous and other metals, 10.2 Mt of oil equivalent; cement, 3.2 Mt of oil equivalent; mining and pelletization, 3 Mt of oil equivalent; and ferroalloys, 3.1 Mt of oil equivalent.

Coal.—The Brazilian coal industry is not a large component of the minerals industry. Coal production is concentrated in the southern States of Rio Grande do Sul, 57.6%; Santa Catarina, 39.8%; and Parana, 2.6%, with minor production from Minas Gerais. Brazil's total production of coal (run-of-mine) in 1995 was about 9.12 Mt, which was transformed into 5.17 Mt of marketable product, and remained at about the same level as that of 1994. Coal consumption at yearend reached 15.7 Mt. Metallurgical coal represented 67% of this total consumption and the remainder was for power generation.

Most Brazilian coal is of lower quality than Colombian coal. Total Brazilian coal reserves were estimated at 23.7 billion tons. In 1995, imports of metallurgical coal amounted to about 10.5 Mt. The main sources of imports were the United States with 50%; Australia, 25%; Canada, 9%; and Poland, 7%. The remainder came from Colombia, Germany, South Africa, and Venezuela. According to the Brazilian Steel Institute, there were plans to invest $7 billion in 5 years to expand steel production from 24.8 Mt to 32 Mt. This expansion was based on imported metallurgical coal.

Natural Gas and Petroleum.—The gas pipeline linking the Enchova platform in the offshore Campos Basin to Macaé, Río de Janeiro, has added 5-million-cubic-meter-per-day of gas flow to the Río de Janeiro and São Paulo markets.

BRASPETRO, the international operating subsidiary of PETROBRAS, continued producing natural gas in the Gulf of Mexico. The gas was recovered from the Frederick Field, 27 km off the Louisiana coast by Petrobrás América Inc., a subsidiary of BRASPETRO.

In 1995, petroleum production averaged 719,904 barrels per day, or 262.8 million barrels, while natural gas production amounted to 22.8 million cubic meters. In 1995, Brazil's imports of petroleum were 223.4 million barrels at a cost of $3.5 billion; of this total Saudi Arabia supplied 75% and the remainder was supplied by Algeria, Argentina, Kuwait, Nigeria, and Venezuela.

Uranium.—Brazil contains the fifth largest uranium reserves in the world. Reserves in 1995 amounted to about 163,000 t of U_3O_8 and 92,000 t of inferred reserves. Private interests are permitted to participate in uranium exploration and production in Brazil through state-owned joint ventures; however, there is a restriction that no more than 20% of the country's uranium reserves may be exported.

Reserves

In 1995, Brazil was among the world leaders in reserves of the following mineral commodities, by rank: columbium (niobium) (1); talc and pyrophyllite (3); bauxite (4); iron ore (5); manganese (5); and tin (6). *(See table 3.)*

Infrastructure

In 1995, Brazil's railroads comprised 25,268 km of

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1.000-meters (m) gauge, 4,339 km of 1.600-m gauge, 74 km of 1.600- to 1.000-m gauge, 13 km of 0.760-m gauge, and 2,308 km electrified; a total of 32,002 km. The country contained a total of 1,448,000 km of roads: 48,000 km paved and 1,400,000 km gravel and dirt. There was 50,000 km of navigable inland waterways. The major shipping ports were Belém, Manaus, Porto Alegre, Recife, Río de Janeiro, Río Grande, Salvador, and Santos. Among the 271 ships were: 56 tankers, 15 chemical tankers, 10 liquefied natural gas, 14 combination ore and oil, 82 bulk, and 2 combination bulk vessels. There were 2,000 km of crude petroleum pipelines, 3,804 km of refined petroleum product pipelines, and 1,095 km of natural gas pipelines. In 1994, Brazil's installed electrical generating capacity was 52,865 megawatts. Total production of electric power for the year was 202,280 gigawatt hours, which translated into 1,340 kilowatt hours per capita.

Power investment negotiations were underway between the Brazilian Government and five companies, four of which were foreign subsidiaries. The companies involved were Alcan Aluminio do Brasil, S.A. (Canada), Alcoa Aluminio, S.A. (United States), Billiton Metais, S.A. (Netherlands), Dow Química, S.A. (United States), and the Brazilian company Camargo Corréa Industrial, S.A. The proposal submitted by the five companies was to build a 1,200-MW dam on the Tocantins River on the border between Maranhão and Tocantins States. A Billiton spokesperson stated that the dam construction would cost approximately $1 billion and that Billiton has pledged $350 million. The companies all have been receiving electricity from the Tucurui Dam on the Tocantins River, but the demand has been increasing at such a rapid rate that the demand could exceed the supply in a very few years. Another factor was the 10% subsidy on electricity prices that expires in the year 2004.

During the past several years, the lack of funding has led to a significant deterioration in the quality of Brazilian highways. A recent World Bank study found that 28% of the country's highways was in bad condition versus only 10% in the early 1980's. Another study found that the lack of proper maintenance of Brazilian roads added 10% to 15% to the total transportation costs in the country.

A study by the IBS found that the loading of 1 ton of steel at the Port of Santos cost $32.50. In comparison, the average cost of loading 1 ton of steel in Asian, European, and U.S. ports was $4.50. At the Ports of Rio de Janeiro and Vitória, the costs exceeded $10.00 per ton of steel.

The ports of Brazil were found to require heavy investments in modernization and expansion. The bottlenecks resulting from the lack of capacity were so great that Brazilian importers paid almost $300 million in penalties charged by ships that had to wait in line to be unloaded.

Constran, S.A. Construção e Comércio of the Itamaraty Group, of the private sector of Brazil, plans to construct 1,718 km of additional railroads linked to the existing railroad system. The cost of the new system was projected to be $2.5 billion. This addition will connect to the existing system, which runs through Vitória, Espírito Santo; Belo Horizonte, Minas Gerais; Santos, São Paulo; and Chapadao do Sul, Mato Grosso do Sul. The new railroad system will run from Chapadao do Sul, Mato Grosso do Sul, to Cuiabá, Mato Grosso, and Santarem, Pará, branching from Cuiabá, Mato Grosso, to Porto Velho, Rondônia.

Outlook

Brazil established a favorable climate for potential foreign investors by keeping inflation under control, reducing public deficit along with improvements in its external debt, providing stable rules for capital repatriation and profit remittances, reducing the tax burden, and recently reviewing its 1988 Constitution. Clearly, the flow of foreign capital into the Brazilian economy would support continued economic growth. A factor that may have a negative effect over the longer term is the environment, especially in the Amazon rain forest. Much depends on what approaches are used to protect the environment and to continue within a path of sustainable development.

Brazil's new currency, the "Real," introduced on July 1, 1994, curbed inflation from 50% per month by June 1994 to about 2% at yearend and economic growth was about 4.2%. Most sectors of the Brazilian economy recorded positive growth during 1995, the mineral sector increased 3.1%, and if that positive rate of economic growth is sustained into 1996 and beyond, the minerals sector, for instance, should continue its recovery as the demand for mineral exports and steel intensive goods increase.

Brazil's economic plan for stabilization "Plano Real," in comparison to past plans, was based on constitutional reviews and privatization of state-owned companies to increase capital flow into the country. There were no price freezes and the "Real Plan" relied solely on macroeconomics to achieve its goals, and on strict control of the domestic deficit, issuance of the "Real," stable foreign exchange rates, renegotiation of its international debt on favorable terms, and reduction of tariffs and nontariff barriers should position Brazil for a brighter and better future.

Foreign direct investment into the Brazilian mining industry appears to be enhancing exploration and mine development activities, particularly in gold. This is because of Government's aggressive economic policies, Brazil's diversified minerals endowment, skilled labor, and its constitutional reform that eliminated restrictions on foreign investment in this sector, in particular. Therefore, these policy changes are enhancing the prospects of new mining projects and stimulating the return of major international mining companies to Brazil. This trend should continue as several corporations are already

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acquiring exploration properties and mining prospects, particularly for gold, and new investors are showing interest in the Brazilian mineral industry.

In the mineral industries, the steel industry was privatized and the petrochemicals and mining sectors are going towards privatization. However, new projects in the petroleum sector will be open up to joint ventures. The giant mining firm CVRD, 51% Government and 49% private, is scheduled for privatization in early 1997, but there is resistance in the Brazilian Senate. According to the Institute of Brazilian Issues and the Fundação Getúlio Vargas, Senators from the north and the northeast of Brazil see CVRD as a large regional development agency, and others, such as Senator Vilson Kleinubing suggested that CVRD is going to be sold to make new CVRDs. However, if this privatization is implemented, CVRD will be able to expand investments and production in several mine projects in the near future.

Privatization of state-owned firms has led to lower employment levels and greater efficiencies; as a result, the Brazilian economy became more competitive in the global economy. Privatization of Government monopolies, dismantling all trade barriers, and increased exports to the world markets will continue to be important, allowing continued inflow of fresh capital into the Brazilian economy.

Improvements and additional infrastructure will have a direct bearing on Brazilian industries in the foreseeable future. The planned Ferronorte railroad system and modernization of existing ports should augment Brazil's ability to increase industrial production and competitiveness. The sectors most likely to be affected are those that depend most heavily on electricity and transportation facilities. The aluminum, auto, steel, petrochemical, and pulp and paper industries, which depend heavily on energy and on exports, will benefit most from new and improved infrastructures. Estimates indicate that the current Brazilian network will require $4 billion investment over the next 10 years. Foreign majority participation in direct mining operations and foreign investment in new infrastructure have been barred by the Brazilian Constitution of 1988. However, the constitutional amendment to eliminate the distinction between domestic and foreign capital should eliminate these restrictions once fully implemented.

As the barriers to foreign investments continue to fall, foreign interests will increase, because Brazil is a country with great mineral potential. The Amazon region alone is considered to have possibilities for major undiscovered mineral deposits, as suggested by the large reserves of iron ore, manganese, bauxite, gold, and tin in Carajás, Pará, already producing under CVRD.

[1]Where necessary, values have been converted from Brazilian cruzeiros (Cz$) to U.S. dollars at the rate of R$0.9725 = US$1.00.

Major Sources of Information

Comissão Nacional de Energia Nuclear
Rua General Severianao
90 Botáfogo-ZC-02
22290-Rio de Janeiro-RJ-Brasil
Companhia de Pesquisa de Recurso Minerais
Avenida Pasteur 404-Anexo, 2° Andar, Pria Vermelha
22290-Rio de Janeiro-RJ-Brasil
Conselho de Não-Ferrosos e de Siderurgia
Esplanados dos Ministerios-Bloco 6-5° Andar
70053-Brasilia-DF-Brasil
Conselho Nacional do Petróleo
SGAN-Q.603 Modulos J, I e H
70830-Brasilia-DF-Brasil
Instituto Brasileiro de Mineração
Avenida Afonso Pena, 3880 3°, 4° e 5° Andares
30000-Belo Horizonte-MG-Brasil
Departamento Nacional de Produção Mineral
Ministério da Minas e Energia
SAN-Quadra 01-Bloco "B"
70040-Brasilia-DF-Brasil
Petróleo Brasileiro, S.A.
Avenida República do Chile, 65
20035-Río de Janeiro-RJ-Brasil
Rio Doce Geológica e Mineração, S.A.
Avenida President Wilson 11° Andar
22030-Rio de Janeiro-RJ-Brasil

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TABLE 1
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS						
Aluminum:						
Bauxite, dry basis, gross weight		10,400,000	9,366,000	9,669,100 r/	8,673,000 r/	11,370,000 3/
Alumina		7,420,000	1,833,000	1,853,000	1,868,000	1,870,000
Metal:						
Primary		1,140,000	1,193,000	1,172,000 r/	1,185,000 r/	1,180,000 3/
Secondary		62,000 e/	66,000	62,000	90,000 r/	90,000
Beryllium, beryl concentrate, gross weight		850 e/	850	850	900 e/	900
Cadmium, metal, primary		200 e/	200	200	300 e/	300
Chromium:						
Crude ore		142,460	198,000	127,000 r/	149,000 r/	175,000 3/
Concentrate		86,749	98,588	86,759 r/	85,879 r/	86,000
Marketable product 4/		62,500	64,000	63,000 r/	62,500 r/	62,500
Cobalt: e/						
Mine output, Co content by hydroxide		400	400	400	400	400
Metal, electrolytic		240	240	240	240	180
Columbium-tantalum ores and concentrates, gross weight:						
Columbite and tantalite		290 e/	200	180	180 e/	180
Djalmaite concentrate e/		10	10	10	10	10
Pyrochlore concentrate, Cb_2O_5 content		30,500	17,807 r/	10,010 r/	15,240 r/	23,890 3/
Copper:						
Mine output, Cu content		37,947	39,845	43,568	39,674	49,000 3/
Metal:						
Primary		141,443	157,950	161,102 r/	170,027	165,000
Secondary		37,035	52,244	54,000 r/	54,290 r/	54,000
Gold:						
Mine output	kilograms	34,053	39,044	39,894 r/	40,188 r/	42,000
Garimpeiros (independent miners)	do.	55,525	37,000 r/	30,000	30,347 r/	30,000
Total	do.	89,578	76,044 r/	69,894 r/	70,535 r/	72,000
Iron and steel:						
Ore and concentrate (marketable product): 5/						
Gross weight	thousand tons	151,500	146,447	150,000 r/	168,000 r/	186,000 3/
Fe content		98,800	95,200	104,000	108,800 r/	131,000 3/
Metal:						
Pig iron	thousand tons	22,700	23,200	24,000	25,200	25,200
Ferroalloys, electric-furnace:						
Chromium metal e/		37	37	37	37	37
Ferrocalcium silicon		21,700	22,800	22,000 e/	25,000 e/	25,000
Ferrochromium		82,225	91,100	83,892	77,105	77,100
Ferrochromium silicon		4,524	6,760	4,500	5,000 e/	5,000
Ferrocolumbium		19,000	16,300	19,000	19,000 e/	19,000
Ferromanganese		169,103	178,937	201,500 r/	494,000 r/	130,000 3/
Ferromolybdenum		47	–	47	47 e/	47
Ferronickel		34,069	33,500	34,000 e/	34,000 e/	34,000
Ferrophosphorus		864	800	800 e/	2,000 e/	2,000
Ferrosilicon		190,864	243,838	284,147	270,000 r/	270,000
Ferrosilicon magnesium		10,200	10,600	10,000 e/	15,000 e/	15,000
Ferrosilicon zirconium		102	104	102	1,500 e/	1,500
Ferrotitanium		12	4	126	500 e/	500
Ferrotungsten		1	–	1	25 e/	25
Inoculant		24,400	20,900	24,500	25,000 e/	25,000
Silicomanganese		272,046	299,995	248,000 r/	248,000 r/	167,000 3/
Silicon metal		106,002	93,734	106,000	110,000 e/	110,000
Total		935,237 r/	1,019,409	1,038,652 r/	1,329,214 r/	884,209

See footnotes at end of table.

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TABLE 1–Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS–Continued						
Steel, crude, excluding castings		22,617	23,934	25,207	25,747	25,076 3/
Semimanufactures, flat and nonflat e/		25,000	25,000	25,000	25,000	25,000
Lead:						
Mine output, Pb content		7,273	2,517 r/	117 r/	806 r/	1,000
Primary		22,023	24,500	27,500 r/	14,602 r/	15,000
Secondary		42,000	38,267	47,027 r/	34,530 r/	35,000
Manganese metal: e/						
Primary		6,500	6,500	6,500	6,500	6,500
Secondary		1,600	1,600	1,600	1,600	1,600
Manganese ore and concentrate, marketable, gross weight 4/		2,000,000	1,703,000 r/	1,837,000 3/	2,100,000 r/	2,390,000 3/
Nickel:						
Mine output, Ni content		26,376	29,372 r/	32,154 r/	32,663 r/	33,000
Ferronickel, Ni content		8,620	8,742	8,683 r/	8,815 r/	9,000
Rare-earth metals, monazite concentrate, gross weight e/		719 3/	770	770	770	770
Silver 6/	kilograms	154,000	162,000	103,000 r/	50,400 r/	55,000
Tin:						
Mine output, Sn content		29,253	27,500	27,000	22,500 r/	22,370 3/
Metal:						
Primary		25,776 r/	27,000 r/	26,900 r/	20,400 r/	20,500
Secondary e/		250	250	250	250	250
Titanium concentrates, gross weight:						
Ilmenite		69,064	76,558	90,567 r/	97,439 r/	97,500
Rutile		1,094	1,798	1,744 r/	1,911 r/	2,000
Tungsten, mine output, W content		223	205	245 r/	155 r/	200
Zinc:						
Mine output, Zn content		130,000	149,000 r/	171,800 r/	145,900 r/	150,000
Metal, smelter:						
Primary		157,462	180,414 r/	183,393 r/	187,304 r/	183,033 3/
Secondary		5,538	7,000	7,200 r/	7,000	7,000
Zirconium, zircon concentrate, gross weight 7/		18,590	16,874	13,252 r/	17,064 r/	17,100
INDUSTRIAL MINERALS						
Asbestos:						
Crude ore e/		3,950,000	2,900,000	3,950,000	3,950,000	3,950,000
Fiber		237,000	170,000	185,000	192,050 r/	208,000 3/
Barite:						
Crude		50,978	72,172	75,835 r/	48,287 r/	70,000
Beneficiated		46,784	54,490	32,068 r/	31,499 r/	32,000
Marketable product e/ 4/		65,000	65,000	65,000	65,000	65,000
Calcite		35,700 r/	31,074 r/	32,296 r/	32,798 r/	35,000
Cement, hydraulic	thousand tons	27,490	23,903 r/	24,843 r/	25,230 r/	25,500
Clays:						
Bentonite (beneficiated)		130,000	131,000	130,000	130,000	130,000
Kaolin:						
Crude		1,838,000	1,632,538 r/	1,560,000 r/	1,800,000 r/	1,800,000
Beneficiated		746,000	810,976	900,000 r/	953,000	1,000,000 3/
Marketable product e/ 4/		1,090,000 3/	1,100,000	1,100,000	1,100,000	1,100,000
Diamond: e/						
Gem	thousand carats	600	650	700	700	700
Industrial	do.	900	665	600	600	600
Total 8/	do.	1,500	1,315	1,300	1,300	1,300
Diatomite:						
Crude e/		32,000	35,000	35,000	35,000	35,000
Beneficiated		12,446	14,669 r/	15,669 r/	17,018 r/	17,000
Marketable product e/ 4/		13,100	13,100	13,100	13,100	13,100
Feldspar:						
Crude		119,286	202,632 r/	205,000 r/	205,000 r/	205,000
Feldspar, marketable product e/ 4/		122,000	122,000 3/	122,000	122,000	122,000
Leucite, marketable product e/ 4/		5,000	5,000	5,000	5,000	5,000
Sodalite, crude, marketable product e/ 4/		500	500	500	500	500
Total e/ 4/		127,500 r/	127,500	127,500	127,500	127,500

See footnotes at end of table.

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TABLE 1–Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS–Continued						
Fluorspar:						
Crude e/		300,000 3/	250,000	250,000	250,000	250,000
Concentrates, marketable product:						
Acid-grade		52,400	61,432	68,325 r/	68,890 r/	70,000
Metallurgical-grade		28,900	22,264	24,566 r/	21,041 r/	20,000
Total		81,300	83,696 r/	92,891 r/	89,931 r/	90,000
Graphite:						
Crude e/		650,000	650,000	650,000	650,000	650,000
Marketable product:						
Direct-shipping crude ore		7,298	8,957 r/	9,960	9,670 r/	10,000
Concentrate		26,965	29,414	29,472	35,965 r/	36,000
Total		34,263	38,371 r/	39,432 r/	45,635 r/	46,000
Gypsum and anhydrite, crude		966,651	887,742 r/	873,719 r/	788,877 r/	780,000 3/
Kyanite: e/						
Crude		750	750	750	750	750
Marketable product 4/		600	600	600	600	600
Lime, hydrated and quicklime	thousand tons	5,000	5,240	5,700 e/	5,700 e/	5,700
Lithium, concentrates e/		1,560 3/	1,600	1,600	1,600	1,600
Magnesite:						
Crude		879,477	1,001,724	974,161 r/	1,019,688 r/	1,000,000
Beneficiated		242,000	273,014	232,367	279,751	282,000 3/
Mica, all grades e/		5,080	7,000	7,000	7,000	7,000
Nitrogen, N content of ammonia e/		940,000	940,000	940,000	940,000	940,000
Phosphate rock including apatite:						
Crude: e/						
Mine product	thousand tons	27,000	27,000	27,000	27,000	27,000
Of which, sold directly	do.	35	35	35	35	35
Concentrate:						
Gross weight	do.	3,280	2,825 r/	3,419	3,937 r/	3,590
P_2O_5 content e/	do.	650	650	700	700	700
Pigments, mineral, other, crude e/		3,000	2,500	2,000	2,000	2,000
Potash, marketable (K_2O)		100,667	85,035 r/	173,368	242,343 r/	370,000 3/
Precious and semiprecious stones except diamond, crude and worked: e/						
Agate		3,000	3,000	3,000	3,000	3,000
Amethyst		1,000	1,000	1,000	1,000	1,000
Aquamarine		20	20	20	20	20
Citrine		100	100	100	100	100
Emerald		90	90	90	90	90
Opal		500	500	500	500	500
Ruby	value	$10,000	$10,000	$10,000	$10,000	$10,000
Sapphire	do.	$15,000	$15,000	$15,000	$15,000	$15,000
Topaz		50	50	50	50	50
Tourmaline		80	80	80	80	80
Other		500	500	500	500	500
Quartz crystal, all grades		1,930	1,604 r/	4,224 r/	3,963 r/	4,000
Salt:						
Marine	thousand tons	3,703	4,030	4,780 r/	4,670 r/	4,700
Rock	do.	1,200	1,231	1,400 r/	1,373 r/	1,400
Silica (silex) e/	do.	1,600	1,600	1,600	1,600	1,600
Sodium compounds: e/						
Caustic soda		1,050,000	1,050,000	1,050,000	1,050,000	1,050,000
Soda ash, manufactured (barilla)		200,000	200,000	200,000	200,000	200,000
Stone, sand and gravel: e/						
Dimension stone:						
Marble, rough-cut	cubic meters	200,000	200,000	200,000	200,000	200,000
Slate		50,000	50,000	50,000	50,000	50,000
Crushed and broken stone:						
Basalt	cubic meters	1,300,000	1,200,000	1,200,000	1,200,000	1,200,000

See footnotes at end of table.

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TABLE 1–Continued
BRAZIL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS–Continued						
Stone, sand and gravel–Continued:						
Crushed and broken stone–Continued:						
Calcareous shells		450,000	450,000	450,000	450,000	450,000
Dolomite	thousand tons	3,500	3,500	3,500	3,500	3,500
Gneiss	cubic meters	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Granite	thousand cubic meters	60,000	60,000	60,000	60,000	60,000
Limestone	thousand tons	60,000	60,000	60,000	60,000	60,000
Quartz 9/		250,000	250,000	250,000	250,000	250,000
Stone, sand and gravel e/–Continued:						
Crushed and broken stone–Continued:						
Quartzite:						
Crude		400,000	400,000	400,000	400,000	400,000
Processed		200,000	200,000	200,000	200,000	200,000
Sand, industrial		2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
Sulfur:						
Frasch		5,456	18,182	21,924 r/	20,708 r/	21,000
Pyrites		66,447	24,684	1,700 r/	153 r/	1,500
Byproduct:						
Metallurgy		163,576	184,057	183,529 r/	182,638 r/	183,000
Petroleum		46,826	58,513	58,582 r/	53,256 r/	55,000
Total		282,305	285,436	265,735 r/	256,755 r/	260,500
Talc and related materials:						
Talc:						
Crude		292,270	286,000 r/	320,000 r/	360,000 r/	360,000
Marketable product e/ 4/		1,960 3/	1,500	2,000	2,000	2,000
Pyrophyllite, crude		186,000	144,000 r/	160,000 r/	148,000 r/	150,000
Vermiculite						
Concentrate		11,031	11,615 r/	14,541 r/	16,000 r/	16,000
Marketable product 4/		2,206 r/	3,393 r/	3,514 r/	4,000 r/	4,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous, marketable 4/	thousand tons	4,254	4,605 r/	4,581 r/	5,122	5,173 3/
Coke, metallurgical, all types	do.	162	143	227 r/	118 r/	200
Gas, natural, gross	million cubic meters	6,600	6,970	7,355 r/	7,756 r/	8,115 3/
Natural gas liquids e/	thousand 42-gallon barrels	12,900 3/	13,000	13,000	13,000	13,000
Petroleum:						
Crude	do.	236,000	228,000	234,792 r/	243,831 r/	257,127 3/
Refinery products: 10/						
Gasoline	do.	146,000	146,000 e/	134,000	126,000 e/	126,000
Jet fuel	do.	20,400	20,500 e/	19,000	17,800 e/	17,800
Kerosene	do.	1,540	1,540 e/	1,450	1,370 e/	1,370
Distillate fuel oil	do.	171,000	171,000 e/	157,000	149,000 e/	149,000
Lubricants	do.	4,870	4,900 e/	4,350	4,120 e/	4,120
Residual fuel oil	do.	90,900	90,900 e/	83,000	79,000 e/	79,000
Other	do.	68,900	69,000 e/	63,400	60,000 e/	60,000
Refinery fuel and losses	do.	23,700	23,700 e/	21,800	20,600 e/	20,600
Total		527,310	527,540 r/ e	484,000	457,890	457,890

e/ Estimated. r/ Revised.

1/ Table includes data available through May 1996.

2/ In addition to the commodities listed, bismuth, molybdenite, and uranium oxide are produced, but output is not reported, and available information is inad make reliable estimates of output levels.

3/ Reported figure.

4/ Direct sales and/or beneficiated (marketable product).

5/ Includes sponge iron as follows, in thousand metric tons: 1991-94–260; and 1995–270 (estimated).

6/ Officially reported output; of total production, the following quantities are identified as secondary silver (the balance being silver content of other ores and concentrates), in kilograms: 1991–73,000 (revised); 1992–21,170 (revised); 1993–20,650 (revised); 1994–14,760 (revised); and 1995–15,000 (estimate

7/ Includes baddeleyite-caldasite.

8/ Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners.

9/ Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional quantities of common quartz.

10/ Figures represent officially reported production to the United Nations (Energy Statistics Yearbook) by the Ministry of Mines and Energy of Brazil.

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THE MINERAL INDUSTRY OF

CANADA

By David B. Doan

Canada's gross domestic product (GDP) during 1995 reached $622.4 billion,[2] an increase of about 2.5% over that of 1995, while the total value of production of all mineral commodities exceeded 5% of GDP, up from a corresponding figure of about 4% the year before. This was a robust performance by the mineral industry of Canada that boded well for the future of this sector of the national economy. For most of 1995, the economy, as well as the entire nation, had been concerned over the prospect of secession by the Province of Quebec from the remainder of Canada. The country was troubled by "...high debt, an intrusive public sector, sky-high taxes, and a weak currency"[3] and facing the spectre of default on its debt, according to various academicians, if Quebec delivered a "Yes" vote on secession. Things turned out otherwise by a narrow margin, but this was enough to provide positive impetus to the currency and credit markets for a relatively strong fourth quarter. Unit labor costs and payrolls turned around during the year, exports as a proportion of real GDP were up smartly, Government spending decreased further, and employment in the public sector turned down sharply. Lifted by improved productivity, strong U.S. demand, and the Free Trade Agreement, exports rose to 42% of the GDP. Overall, the economy strengthened to a degree that engendered forecasts that the Canadian dollar would reach parity with the U.S. dollar by the end of the decade.

Higher prices were a significant factor in the mineral sector, especially in the base metals, which helped to revive exploration and production. Moreover, exploration for diamond spread to most of Canada, with prospects identified all the way from the Northwest.

Territories to Quebec. In Labrador, diamond prospectors happened across a gossan, or strongly oxidized surface zone, capping what has emerged as a huge nickel-copper-cobalt deposit at Voisey Bay, where drilling results confirmed an unusually large, high-grade ore body that excited great interest in the mining world. Although a steady stream of Canadian mining companies has entered Central America and South America, where the welcome has been reassuring, such discoveries as Voisey's Bay reaffirmed that there is much still to be explored in Canada. Outlay for 1995 exploration costs amounted to about $458 million, up sharply from the $348 million spent the previous year. The total area covered by mineral claims totalled 16 million hectares, equal to 160,000 square kilometers (km^2).

Environmental concerns continued to influence mineral exploration and development activity throughout Canada, leading some companies to look elsewhere for projects. Latin America beckoned, as companies became aware of countries where foreign investment was welcomed, mining laws were seemingly coherent and reasonable, and profits could be repatriated. In the meantime, however, under the rubric of sustainable development, Canada mounted a strong effort to reconcile the disparate views of the mining industry, the Federal Government, Provincial interests, the economy, environmentalists, the First Nation or aboriginal peoples, the social infrastructure, and requirements for materials. It is not yet clear how these interests will react with one another, nor whether a complete equilibrium will ever be achieved, but efforts thus far reflect great effort by the many entities that are striving to preserve the Canadian mineral industry.

Government Policies and Programs

Primary jurisdiction over mineral resources in Canada is exercised by Provincial governments. Exceptions have been the Yukon Territory and the Northwest Territories which, while still under the resource-management control of the Federal Government, were slowly moving toward greater powers.

Federal and Provincial policies (though not entirely consistent between Provinces) are generally stable and have traditionally favored research and information services relating to the mining industry. The Federal Government had negotiated multiyear Mineral Development Agreements with Provincial governments that fund initiatives intended to strengthen the mining industry in each region. One of these is a Canadian Geoscience Information Center to provide centralized access to technical information on the geology of Canada.

Although new environmental assessment legislation was passed in 1992, the Government has been deliberate in producing regulations implementing the new laws. One subsequent measure, however, was tax deductibility for funds set aside for cleanup of closed mine sites, thus complementing emerging Provincial reclamation requirements.

The recent shift of international mining investment away

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from Canada has prompted industry representatives to urge changes in both regulation and taxation of the mining industry. For example, the industry has been critical of the complex regulatory process for approving new mines in the Province of British Columbia, where mining has traditionally been a major activity. The eventual disapproval of the Windy Craggy project, with a potential value of billions of dollars and untold significance to the Provincial economy, shocked the companies involved and registered poorly with the mineral industries across Canada. Although the Province itself promised to speed up the mine approval process, the national situation was brought into sharp focus in 1995 by the huge nickel-copper-cobalt discovery at Voisey's Bay. A media concensus held that the Goverments have come to realize that if this project, with its immense potential, does not go forward, then no project will.

Meanwhile, the Government of British Columbia announced an arrangement to compensate Royal Oak Mines Inc. for the loss of the Windy Craggy project. Royal Oak would receive some $29 million in cash as well as other complex considerations relating to the development of another deposit in the Province, that essentially cost tax dollars to the Province and precluded the possibility of mining the deposit for the foreseeable future.

Environmental Issues

Natural Resources Canada published a paper, "Sustainable Development and Minerals and Metals",[4] that probed deeply the plethora of issues relating to exploration, mining, reclamation, recycling, toxicities, energy efficiencies, the roles of industry and Government, assessment of risk, mineral access and tenure, social infrastructure, and international linkages in science and technology. Designed to stimulate thinking by tackling environmental considerations head-on, the paper represented a move toward the amicable organization of policy between factions as well as the establishment of commonality in terms of reference within the issues involved. Although this publication was only a first step in the reconciliation of interests, it seemed to represent a substantial response politically, technically, and socially to the environmental problems facing not only Canada but much of the remainder of the world.

Meanwhile, the Supreme Court of Canada upheld Ontario's rigorous Environmental Protection Act, rejecting arguments that wording of the law was too vague. As approved, the law forbids the release of any contaminant that "causes or is likely to cause impairment of the quality of the natural environment for any use that can be made of it." This suggested such imponderables as how to define terms in this law so as to accept the application of salt to icy roads but preclude any release of greenhouse gases into the atmosphere by snowplows.

A study prepared for Federal and Provincial energy ministers projects that it would cost Canada's petroleum refineries more than $3 billion to meet new environmental standards aimed at limiting greenhouse gas emissions. Changes to gasoline formulation and emissions standards would add about 8 cents to the cost of a liter of gasoline, or about $0.30 per gallon.

Having shut down the multibillion-dollar Windy Craggy copper-gold-silver-zinc-cobalt mine development in northern British Columbia two years ago, environmental forces were mobilizing to do the same thing to Huckleberry Mines Ltd.'s $120-million copper-gold-molybdenum-silver mine development near Smithers, British Columbia. A group calling itself the "Canadian EarthCare Society" charged that the Huckleberry project was being rushed to approval in secret dealings to which the media and public were excluded. However, Environmental Assessment Office authorities stated that meetings were proceeding in an orderly way, being closed to the public only to permit frank and open discussion, and that minutes of all meetings were available. At that, they estimated that any approval of the project would not come before late 1996.

Production

Total value of 1995 production of all mineral commodities, including mineral fuels, amounted to $31.62 billion, an increase of about 5.4% over that of the previous year.

Copper production in 1995, at 729,000 metric tons (t), climbed by more than 23% compared with that of the previous year. Silver output, although quantitatively smaller, increased a conspicuous 61% beyond that of the previous year. Gold, nickel, and zinc mine production registered gains of 1.8%, 17.5%, and 12% respectively. Generally higher base-metal prices since 1994 resulted in improvement in overall production value such that increases in volume of production were eclipsed by greater relative increases in value of production.

The value of production for the metals group overall, $8.74 billion, showed an increase of 23% over that for the previous year. The total value of production for the nonmetallic group and structural minerals, at $2.07 billion and $1.90 billion, respectively, showed increases over the previous year of 8.8% and 1.1%, respectively, in 1995.

Based on value of production, the top nonfuel commodities in 1995 were copper ($2.04 billion), gold ($1.82 billion), nickel ($1.46 billion), zinc ($1.17 billion), potash ($1.09 billion), and iron ore ($870 million). Among the fuels, coal added $1.38 billion to the value of production. As in previous years, the fluid hydrocarbons led the field of all mineral products, petroleum crude production having reached a value of $11.24 billion. Natural gas output, at a value of $4.987 billion, was down sharply from the previous year. *(See table 1.)*

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Trade

As the world's greatest exporter of minerals and metals, Canada enjoyed benefits to its economy from its mineral industry that included a significant contribution to its trade surplus position, and hence to its merchandise trade balance, as well as major support of the national standard of living. Mineral and mineral-product exports, including fuels, totalled $44.66 billion in 1995, an increase of about 14.8% over the comparable figure for 1994. Metals registered 58% of the increase in exports, fuels accounted for about 29%, nonmetals about 9%, building materials about 1.8%, and other minerals about 2.2%.

Value of exports of nonfuel minerals (but including coal) was $29.2 billion for 1995, representing an increase of 16.2% over the previous year. Included in these exports were crude minerals, smelted and refined products, and semifabricated and fabricated products. Prominent among the crude minerals exported were iron ore, potash, and sulfur to the United States; copper concentrates to Japan; iron ore and zinc concentrates to the European Union (EU); smelted and refined metals, including aluminum, copper, gold, iron and steel, nickel, silver, and zinc to the United States; aluminum and gold to Japan; and copper and nickel to the EU. Coal exports went mostly to Japan.

Mineral and mineral-product imports, including fuels, were valued at $29 billion, amounting to about 17.6% of the value of all imports by Canada in 1995. In terms of net trade, a $20.4- billion surplus was gained for minerals, including fuels, for the year.

Total trade between the United States and Canada exceeded that of any other two countries in the world, amounting to $147 billion in 1995. This was down about 2% from 1994 but represented greater diversification of Canada's export markets.[5]

Structure of the Mineral Industry

The Canadian mineral industry comprised as many as 3,000 domestic and perhaps 150 foreign companies. Companies whose corporate voting rights were at least 50% non-Canadian were considered foreign, although other distinctions could apply in some large companies. About 320 mine sites were active, including coal but excluding sand, gravel, and other construction materials. At least 40 smelters were in operation, as well as other processing plants in the iron and aluminum industries that were not smelters in the usual sense. oreign companies were subject to the same taxes as domestic companies, but repatriation of earnings was unimpeded.

As a whole, the Canadian mineral industry was privately owned, with the exception of some Government participation in potash and petroleum, but even these were in transition to private ownership. Some companies, such as Potash Corp. of Saskatchewan Inc. and Saskatchewan Oil & Gas Corp., were owned in part by the Province of Saskatchewan. Moreover, the Province of Alberta owned part of Alberta Energy Co. Ltd. Although the proportion of Government ownership was changeable, the trend was toward privatization. Petro-Canada was owned partly by Federal and partly by Provincial Governments but was expected to become completely privatized. A large proportion of the total number of mining and petroleum companies was partly public-owned, with shares trading on various exchanges in Canada and, in many cases, the United States.

Overall, the mineral industry in Canada consisted of underground mines, open pits, leaching operations, concentrators, smelters, and refineries, as well as drilling and production operations characteristic of the petroleum industry. Table 2 depicts the structure of the mineral industry by sectors of the major mineral commodities.

Employment in the mining and mineral manufacturing industries has stabilized after a decline that began in 1989, when the number of jobs in those industries peaked at 422,000. Preliminary employment estimates by Statistics Canada for 1995 indicated that total employment in mining and mineral manufacturing, including coal, was about 341,000, up 4% from that of 328,000 in 1994.

The total number of employees in metal mining, nonmetal mining, quarrying, and coal mining was estimated by Statistics Canada at 61,000, an increase of 3.6% over that of 1994. Employment in nonferrous smelting and refining was estimated at 59,000, up about 4.3% from 1994. Altogether, the mining, smelting, and refining sectors, with an estimated 120,000 jobs, showed a net gain of about 3.9% compared with the previous year. About 9,800 people were also employed in diamond drilling and other support services incidental to mining operations.

Commodity Review

Metals

Aluminum.—Canadian production of primary aluminum in 1995 was 2.172 million metric tons (Mt), a decrease of about 3.7% from the previous year. This put Canada third, after the United States and Russia, in the world in volume of production.

Alcan Aluminum (Alcan) realized increased revenues in 1995 in spite of a $420-million write-down of its Kemano hydroelectric power project near Kitimat, British Columbia, which had been languishing for several years since the beginning of the decade. The $1.4-billion project was the second phase of Alcan's hydroelectric development of the Nechako River system and was scheduled to add 540 megawatts (MW) to Alcan's Kemano generating station, upgrading capacity from 896 MW to 1,436 MW.

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Construction had been halted pending an appeal filed by Alcan to a court ruling providing for an independent environmental review. The company had initiated the project in the first place only after previous environmental reviews and changes to meet Federal and Provincial requirements. Plans were to sell excess power to the British Columbia Hydro Power Authority until such time as Alcan decided to add additional smelting capacity. However, in January 1995, British Columbia's Government announced its intention to cancel the half-built Kemano project following the public release of the British Columbia's Utilities Commission's review of the undertaking. After due consideration, Alcan had little choice but to take the write-down of its losses.

After postponing an investment of $729 million to double its smelter's capacity, Aluminerie Alouette announced that, in 1996, it will begin a 3-year shift from carbon to graphitized cathodes costing about $27 million. This would increase the smelter's capacity from 218,000 tons per year (t/yr) to 229,000 t/yr by boosting the current from the present 218,000 amperes to 315,000 amperes.

Cobalt.—Production of refined cobalt reached 3,092 t in 1995, a modest increase from the previous year but neglecting output, if any, from the new $15-million production facility near Cobalt, Ontario, established by Ego Resources Inc. Ego has developed a proprietary hydrometallurgical process for extracting cobalt from ore, tailings, or mine spoil that involves crushing, grinding, flotation, and solvent extraction. Pure cobalt is then further treated to produce simple salts such as cobalt carbonate. At midyear, the company announced a startup output rate of 300 to 500 pounds [(136 to 227 kilograms (kg)] per day, aiming for 1,600 pounds (727 kg) per day upon reaching capacity. They added that their process has been endorsed by the Ontario Government as consistent with its "green" industries strategy demonstrating that resource development can coexist with environmental responsibility.

Copper.—Mine output of copper increased 23% in 1995, reflecting a dramatic reversal of the previous downtrend of world copper prices. Production of primary refined copper dropped 15% in 1995 as a consequence of the drop in mine production in 1994. At that time metal prices had been soft enough that a number of mines were temporarily closed in British Columbia, reopening again in 1995.

Noranda Mining and Metals Group planned to spend $7 million at its Mines Gaspe copper mine in Quebec to develop the new E-34 ore body, whose minable reserves are projected at more than 1 Mt grading between 3% and 4% copper. An estimated 33,400 t of copper would be extracted, extending the mine life well into 1999. Noranda further announced that it would build a $3-million pilot plant for recovery of copper from stockpiled oxide ore using a solvent extraction-electrowinning (SX/EW) process. Subsequently, over 9 years, a full-scale SX/EW plant would produce about 8,000 t/a of copper cathode at Mines Gaspe. A subsidiary, Noranda Metallurgy Inc., planned an $8-million concentrate-drying and concentrate-injection system that would increase the capacity of its Gaspe smelter from 85,000 t/yr to 110,000 t/yr of copper.

It may be noted that although the SX/EW technique for copper production leads to significant cost savings, all byproduct credits are lost in the process. The revenue flow is thus completely dependent on the price of copper. Canada's many polymetallic copper deposits, normally conferring a so-called risk-reduction advantage as byproduct prices help buoy the revenue stream, lose this benefit during SX/EW operations.

In preparation for a 30th anniversary celebration of the Kidd Creek operation at Timmins, Ontario, Falconbridge Ltd. announced that in drilling downward from their 68 Level (6,800 feet) in the deepest part of the mine, they encountered a copper stockwork, or "feeder" system, between the future 78 Level and the 98 Level that comprises massive sulfides grading 3% copper, 4.8% zinc, 0.85% lead, and 180 grams silver per ton over an estimated average horizontal width of 50 m, plus another 50 meter (m) width of lower-grade material.[6]

The Voisey's Bay discovery, still being evaluated, suggested that Canada, ranking third after Chile and the United States, will continue to be a major world copper producer.

Gold.—Reversing 3 consecutive years of decline, gold production turned around during 1995 and increased to 149 t from the 146 t produced the year before, leading observers to predict that production will reach approximately 170 t by 1998. The pitch of exploration seemed to increase steadily, with various innovations in the chemistry and physics of search techniques supporting the effort both in Canada and by Canadian companies in other countries. Canada was the fourth largest gold producer behind South Africa, the United States, and Australia. There were about 50 primary gold mines in Canada at the beginning of 1995, accounting for 91% of the gold produced, with the remainder coming from basemetal mines (6.5%) and placer operations (2.5%). Total employment in primary gold mines totaled 8,800 in 1993; 8,600 in 1994; and 8,900 in 1995. Employment figures in the gold industry had been declining steadily from the 1988 peak of 12,600 but turned around in 1993.

The Eskay Creek gold mine in northwestern British Columbia, owned by Prime Resources Group, started production in January 1995 at a rate of 6 t/yr of gold. The mine was one of the highest grade precious-metal deposits in the world, according to the company, with reserves of 1.1 Mt, grading 66 grams per metric ton (g/t) of gold and 2,930 g/t of silver. The ore also contained 5.6% zinc and 0.77% copper. Also in British Columbia, Kinross Gold began mining the QR deposit, having reserves of 1.3 Mt grading 4.7 g/t gold, and projected production at the rate

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of 1.7 t/yr for 6 years, evidently in the expectation of discovering additional reserves.

In the Yukon Territory, Loki Gold readied its Brewery Creek project to begin producing in 1996 at a rate of 2.5 t/yr utilizing heap leaching from reserves of 16 Mt grading 1.5 g/t gold. Cameco and Uranerz Exploration and Mining saw the beginning of production at their Contact Lake Mine, Saskatchewan, at a rate of about 2 t/yr from reserves of 1.6 Mt grading 9.6 g/t gold.

In Manitoba, Rea Gold finished its reevaluation of the old San Antonio Mine at Bissett, which has already produced more than a million ounces (31.1 t) according to mining records held by the former owners. Rea carried out a sampling program after pumping out all the levels of the mine, which is more than a mile deep. Reserves are projected at 3.2 Mt grading 9 g/t, and production is anticipated starting in 1997. Also in Manitoba, TVX Gold Inc. and High River Gold Mines Ltd. started production at a rate of about 3 t/yr, from reserves of 4.2 Mt grading 6 g/t gold, in a joint venture to reopen the old Nor-Acme mine 125 kilometers (km) east of Flin Flon.

In Ontario, production was started at the relatively small Eagle River mine, owned by Eagle River Gold Mines, where reserves are projected at 800,000 t but with a grade of 14.1 g/t gold to justify the effort. Eagle expects to produce 1.3 t/yr. Elsewhere in Ontario, in the realm of low-grade production at higher throughput, Placer Dome began production at the Dome open pit mine that has reserves of 32.5 Mt grading 2.4 g/t gold. Mill capacity was increased from 3,800 tons per day (t/d) to 9,100 t/d. Adjacent to the Dome mine, the Paymaster mine began production in 1995 and became part of the Dome complex. Production is projected to increase overall from 6 t/yr to 10 t/yr.

In Quebec TVX and Golden Knight Resources announced plans to develop the Principale deposit at a cost of at least $22 million. Production at the Casa Berardi complex, currently 3 t/yr, was programmed to increase to 4.5 t/yr by the end of 1996. MSV Resources had started production at the Eastmain mine at a rate of 1.6 t/yr, but problems obtruded to the extent that production targets were not met and operations were suspended. Aurizon Mines and Beaufort Mines initiated production at the Beaufort mine with the expectation of reaching an output of 1 t/yr.

Summing up, gold seemed to be the principal targeted metal for exploration virtually throughout Canada. In terms of value of production in Canada, gold was second only to copper in 1995.

Iron Ore.—Canadian production of iron ore climbed in 1995 to 38.28 Mt compared with output in 1994 of 36.42 Mt for a difference of about 5%. This category comprised concentrates, pellets, and sinter from hematite and siderite ores. Major iron-ore producing companies included Quebec Cartier Mining (QCM), Iron Ore Company of Canada (IOC), Wabush Mines, and the Algoma Ore Division (AOD) of Algoma Steel Inc.

QCM produced 16.1 Mt of ore in 1995, 0.1 Mt more than in 1994. Of this, 8.3 Mt, more than one-half, was used for pelletization; the remainder went to sinter feed. Shipments exceeded production so that stocks were drawn down to meet demand. IOC produced 15.9 Mt of ore, of which 10.8 Mt went to pelletization and the remainder to concentrates that were not used for pellets. Wabush Mines turned out 5.3 Mt of iron-ore pellets. AOD produced 975,000 t of sinter at its complex in Wawa, Ontario.

Attention turned to exploration and development in various parts of Canada, including Roche Bay in the Northwest Territories; the Peace River area of Alberta; and at Ungava Bay and Schefferville, both in Quebec.

Pig iron production recovered somewhat from a low output of 8.15 Mt in 1994 to reach a slightly more than 8.46 Mt in 1995, an increase of about 4%. Production of direct-reduced iron was projected at roughly one-tenth of the tonnage of pig iron output. Crude steel production was 14.4 Mt compared with 13.9 Mt in 1994, turning out to be the highest in 5 years, but not equalling the 15.5 Mt of 1989.

Lead and Zinc.—Canada was the world's largest mine producer of zinc and the fifth largest producer of lead in 1995 with a total of 1.111 Mt of zinc and 210,415 tons of lead in concentrates, in both cases an increase over 1994 output. Lead, in particular, was up sharply in showing an increase of 26% compared with production the previous year, while zinc showed a parallel gain of 10%.

The Faro mine in the Yukon, which had been closed in 1993, was purchased by Anvil Range Mining Corp. after completing the necessary financing to reopen the mine. Stripping of the Grum deposit at Faro began late in 1994, and commercial production began in 1995. By August it had reached its capacity of 150,000 t/yr of zinc and 98,000 t/yr of lead in concentrate. These concentrates were shipped from the Port of Skagway, Alaska, beginning in September 1995.

Noranda went ahead with development of its Bell Allard zinc-copper project near Matagami in northern Quebec. After construction of surface facilities, the shaft will be sunk and underground workings undertaken. The projected startup in 1998 would coincide with exhaustion of the Noranda operations at Isle Dieu and Norita East, also in the Matagami district. Bell Allard is expected to have a capacity of 80,000 t/yr of zinc and 5,000 t/yr of copper.

Nickel.—Canadian mine output of nickel in 1995 rebounded strongly from that of the previous year to about 181,000 t of contained nickel, an increase of 21% compared to production in 1994. That year's low figure was primarily due to production cuts by Inco Ltd. during the first quarter of the year while coping with labor problems in the midst of soft market prices.

For most of 1995, the biggest news in nickel was the

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Voisey's Bay nickel-copper-cobalt discovery by Diamond Fields Resources Inc. (DFR) on the coast of Labrador. After 210 exploratory drill holes were completed by the end of the year, a preliminary projection of reserves, relating only to the main ("ovoid") zone, showed 31.7 Mt grading 2.83% nickel, 1.68% copper, and 0.12% cobalt at a total stripping ratio of 0.36:1. But this was not the whole story, as further drilling to eastward, in the "Eastern Deeps" zone, showed even larger targets that in some cases included thicknesses of several hundred m of massive and disseminated sulfide mineralization. By yearend, there were estimates of at least 100 Mt of ore.[7] It was clear that this discovery would affect the economics of nickel production and marketing for some time to come. Also by yearend, Inco had acquired a 30% combined direct and indirect interest in DFR.

Inco's $53-million development program at its new Victor deposit near Sudbury included a 1,768-m exploration shaft, scheduled to be completed by 1998. Inco has also started development work at the McCreedy East Mine near Sudbury, expected to produce 10,000 t/yr of contained nickel and 35,000 t/yr of contained copper by 1999.

Falconbridge Ltd. obtained environmental approval for its Raglan nickel-copper property in northern Quebec. The $350- million operation is scheduled to produce about 20,000 t/a of nickel in concentrate and about 5,000 t/a of copper in concentrate by mid-1998.

Sherritt Inc. formed a separate company, Sherritt International, to pursue its contract with Cuba to set up an enterprise to mine, refine, and market nickel and cobalt internationally. Sherritt's Fort Saskatchewan refinery in Alberta and Cuba's Moa Bay nickel and cobalt concentration plants were included in the joint-venture agreement.

Platinum-Group Metals.—Mine production of platinum group metals (PGM) increased by 11% compared with output in 1994. Canadian production data for these metals represent captive recovery from nickel ore rather than response to market demand. Most Canadian production has been by Inco and Falconbridge from their Sudbury mines plus a smaller amount in Manitoba from Inco's Thompson mine, the HBMS Namew Lake mine, and Outokumpo Mines Ltd. near Flin Flon.

As an approximation based on past corporate reports, Inco's ratio of PGM produced worked out to about 12 : 7.6 : 1 for the group members palladium : platinum : rhodium. Although rhodium thus amounted to only slightly more than one-twentieth of the PGM, its prices have traditionally been significantly higher than for other members of the group, having reached $4,000 per ounce at one point in the past decade. In 1995, however, rhodium prices dipped to levels only slightly higher than those of gold.

PGM recovery is expected to continue in new nickel mining in the Sudbury district. Inco's Victor discovery contains an estimated 18 Mt grading 11.6 g/t PGM plus gold. The McCreedy discovery contains 5 Mt grading 10.6 g/t PGM plus gold.

Silver.—Mine output of silver in concentrate jumped sharply upward in 1995 to a 62% increase over production of the previous year, reaching 1,245 t. This was the highest turnout since 1991, when production equalled 1,339 t, and reflected new mines coming on-stream more than any lasting price incentives in world markets.

Canadian silver production has been largely a coproduct of base metal mining or gold mining, subject to whatever mining incentive applies to the major product, whether, gold, copper, or lead-zinc. Accordingly, silver output suffers when mines close or go on suspension for reasons involving supply, demand, and pricing for other major mineral commodities. A significant addition to production occurred in 1995 when Eskay Creek gold mine in British Columbia came on-stream as the largest producer of silver in Canada, with an expected annual production of 340 t. At yearend, United Keno Hill Mines Ltd. announced plans to reopen the Belle-Keno and Silver King mines in the Yukon Territory, which were shut down in 1989. Total cost would be almost $9 million, but together the mines were thought capable of producing 125 t/yr to 155 t/yr for about 5 years.

Industrial Minerals

Asbestos.—During 1995, Canadian asbestos mines operated at an average of 96% of capacity, while prices increased by about 3%, but preliminary data for the year indicated a drop in output of between 2% and 3% compared with that of 1994.

Increasing concern regarding chrysotile substitutes were expected to benefit the chrysotile industry over the near- to medium term. Marginal gains were expected in Latin American consumption of Canadian chrysotile; but Asia, already a significant market by taking up about 58% of exports, was seen as expanding its demand for Canadian fibers. The U.S. Bureau of Mines estimated that Canadian asbestos imports into the United States in 1995 were about 23,000 t compared with 26,000 t in 1994. Asbestos-cement product demand was consistent as many users continued to favor this combination over substitute fibers and steel.

Quebec's LAB Chrysotile, the largest producer in Canada, was to be closed at some indeterminate time according to announcements in May, 1995. The future of the mine hinged on the results of an exploration program that was already underway so that a decision might be made sometime in 1996. At JM Asbestos Inc., after mine workers invested $2 million in their company and the Government of Québec guaranteed a $25 million loan for the purpose, its development phase was completed and the company contemplated a change from an open pit operation

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to underground mining.

At Cassiar, British Columbia, a joint-venture group comprising Mineral Resources Corp. (formerly Cliff Resources), Strategic Investments, and Black Hill Minerals Ltd., after investing $1.8 million in preparatory work for the construction of a wet milling pilot plant, would need at least $7 million for construction of a full-scale plant for operation in 1997.

Cement.—Canada's 1995 production of cement increased about 1% over that of the prior year, reflecting continued strengthening of the export market in the midst of declining cement prices since 1978 if valued in 1986 dollars.[8] Weakening of the Canadian dollar versus the U.S. dollar since the beginning of the nineties, especially in early 1995, has made Canadian cement prices attractive to U.S. consumers across the border at time when domestic consumption withered in the face of diminishing residential and nonresidential construction. Canada has always been the chief exporter of cement to the United States, except for a brief period in the 1980's when Mexico moderately exceeded Canadian shipments. The 1990 International Trade Commission ruling against dumping of cement by Mexican producers essentially removed them as competitors, leaving the field to Canada as the principal foreign source. For the immediate future, certainly, the success of Canadian cement producers will be based significantly on exports to the United States and hence upon the prospects for U.S. economic growth. Canadian growth and construction, particularly in Ontario, the largest cement market of all the Provinces, will play the key role in determining the balance between domestic and U.S. consumption.

Diamond.—Canada as yet has no commercial production of diamond but the search for potential mines continued unabated. More than 500 companies have been exploring for diamond in Canada, especially in the Northwest Territories, but also in Saskatchewan, Québec, Alberta, Ontario, British Columbia, Manitoba, and Labrador. The field seemed to be narrowing somewhat as various pipes proved disappointing upon testing.

DeBeers, the world's largest diamond group, announced termination of its Yamba Lake joint-venture project with Mill City Gold and Tanqueray Resources in the Lac de Gras area, the focal point of the diamond rush in the Northwest Territories. Observers noted that, with DeBeers' departure, the leading contenders in the area were the BHP/Dia-met joint venture and the Kennecott/Aber Resources Diavik Project. BHP's Diamond Division reported that diamond recovered to date from five kimberlite pipes at its Lac de Gras property, about 300 km northeast of Yellowknife, compared favorably with those at other diamond mines in the world. The company stated that, at current prices for rough diamond, the project to develop the pipes was economically feasible. Capital investment was expected to be in excess of $360 million. The five pipes were located under lakes bearing the same names: Panda, Misery, Koala, Fox, and Leslie, and would be mined during a 30-year period. Preliminary results on two pipes were as follows: Koala, containing 0.75 carat/t, at an average of $110 per carat resulting in an ore value of $82/t; and Panda, 1.18 carat/t at $127 per carat, resulting in an ore value of $150/t. The planned centralized processing plant was to be located southwest of the Koala pit. It would receive 9,000 t/d of ore during the first 9 years of operation and 18,000 t/d thereafter. The cutoff grade would be 0.01 carat. Processing was expected to involve mainly crushing, scrubbing, and dense media separation, plus high-intensity magnetic separation, X-ray concentration, and sorting. The construction pbase work force was projected to reach 1,000 at its peak. After that, about 650 workers would be employed during production.

Graphite.—Canadian shipments of graphite rose slightly in 1995 compared to those of 1994. At the beginning of 1995, Stratmin Graphite Inc. was the only producer of natural flake graphite in North America and, according to the company, was the largest producer and exporter in the world of natural flake graphite from a single mine. In 1994, Applied Carbon Technology (ACT) ceased production in midyear at its plant near Kearney, Ontario. Later that year, Stratmin purchased 49.5% of ACT's shares and advised that the plant would open at such time as the graphite market regained its strength.

Other graphite mines and prospects, primarily in Ontario and Quebec were studied in terms of economics of development and/or production in relation to overall market demand and pricing. It was clear that probabilities of success were marginal, given the dominant position of Stratmin.

Gypsum and Anhydrite.—Production of gypsum and anhydrite declined slightly compared to that of 1994 but nonetheless was higher than in 1993. Production thus far in the 1990's, however, has not equalled the 1989 output of more than 9 Mt prior to Canada's economic recession and accompanying sag in domestic construction.

Production has been mostly by Canadian subsidiaries of U.S. and British companies such as USG Corp. and National Gypsum Co., according to demand for wallboard by both U.S. and Canadian consumers in all building categories. Nova Scotia and Newfoundland produced the bulk of Canadian gypsum, with lesser amounts from Ontario, British Columbia, and Manitoba, in about that order of value. Although gypsum occurs widely in Canada and the world, the relatively high unit weight, low unit cost, and vulnerability to damage of wallboard combine to give gypsum products a relatively high place value, discouraging long-distance transportation. Instead, gypsum industries tend to develop in localities that serve developing construction requirements. As with the cement industry, gypsum production in both Canada and the United States tends to develop in populous areas on both sides of the

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border in localized cross-border competition rather than between all the Provinces or all of the States.

At Caledonia, Ontario, Domtar Inc. operates continuous-mining machines used to extract material from gypsum reserves thought to be sufficient for 75 years. Domtar's Surrey, British Columbia, plant was the first in North America to use large quantities of reclaimed and recycled wallboard. At Hagersville, Ontario, CGC Inc., partly owned (75%) by USG Corp. of Chicago, operated an underground mine and a wallboard facility. Westroc Industries Ltd., a subsidiary of BPB Industries Plc., the largest gypsum products manufacturer in Europe and with worldwide interests, operated in (from east to west) New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia. Westroc manufactured wallboard or other products in each of these Provirces and mined gypsum in Ontario, Manitoba, and British Columbia.

Production data for anhydrite are combined with those for gypsum, but make up only about 2% or 3% of the total for the two materials. About twice as hard and heavier than gypsum, anhydrite is produced in Nova Scotia by Fundy Gypsum Co. Ltd. at Wentworth and by Little Narrows Gypsum Co. Ltd. at Little Narrows.

Potash.—Canadian potash production in 1995 rose by 10% to more than 9 Mt of K_2O equivalent, mostly from mines in Saskatchewan but with about 12% coming from New Brunswick. Canadian potash was shipped mostly to the United States (almost 60%), Asia (about 30%), and Latin America (about 8%), with the remainder going to Oceania and Western Europe. Exports to the United States have risen steadily to satisfy agricultural needs.

Vigoro Corp., Kalium Canada's Chicago-based parent company, acquired the Central Potash Canada operation of Noranda. The transaction, completed in early January 1995, involved a disbursement of $89 million plus $12 million in working capital. Moreover, Vigoro and IMC Global Inc. agreed to merge both companies in an arrangement worth $1.4 billion, pending approval by Government regulatory authority. The merged company would hold 30% of potash capacity in North America to become the second largest producer.

The International Trade Administration of the U.S. Department of Commerce extended for another year the suspension agreement between the United States and Canadian potash producers, which had been due for termination. During the year, investigation continued into allegations of price-fixing in North America by several U.S. and Canadian potash exporters. The investigations were prompted by a class action lawsuit consolidated in Federal District Court in Saint Paul, Minnesota, with a U.S. grand jury studying the matter.

Sulfur.—Production of elemental sulfur increased by about 2% to more than 9 Mt in 1995, representing output from sour natural gas, petroleum refineries, smelters, and tar sands. From the latter, sulfur production increased by more than 6% to a record level of 670,000 t. Smelter gases yielded 860,000 t; petroleum refining and natural-gas scrubbing accounted for the remaining 7.48 Mt. No Canadian production is derived from Frasch mining.

Canada maintained its position as the world's second largest producer, after the United States, of elemental sulfur with a 22% share and remained the leading exporter with a 38% slice of world trade in sulfur. In January 1995, Husky Oil Operations Ltd., Shell Canada Ltd., and Amoco Canada Petroleum Co. Ltd., three major members of the PRISM Sulfur Corp., withdrew from that export organization to begin exporting independently, thus increasing the number of major Canadian exporters from two to five. In July 1995, the U.S. Department of Commerce released preliminary results of its antidumping administrative review of sulfur sales by Canada to the United States during the period December 1991 to November 1992, as requested by Pennzoil Sulfur Co., a former U.S. Frasch producer. The Department set a preliminary dumping margin of 5.66% for three active exporters, a 28.9% rate for nonrespondents, and a 5.56% rate for other exporters who were not listed in petitions or who received revocation. Final determination is anticipated in 1996. Pennzoil has filed two more consecutive requests for the subsequent two 1-year periods, invoking the administrative review process for the next several years.

Mineral Fuels

Coal.—The year 1995 saw Canadian coal production reach a record high of 74.9 Mt, surpassing the previous high of 72.8 Mt produced in 1994. The total value of 1995 production was $1.39 billion, about 5% higher than that of 1994's output. At least part of the incentive for this new record was provided by coal price increases. Overall, production was up in the Western Provinces (Alberta, British Columbia, and Saskatchewan) and down in the Eastern Provinces of New Brunswick and Nova Scotia. Canadian coal consumption in 1995 was about 53 Mt, with 47 Mt going to the generation of electricity, 4 Mt used in steel-making, and 2 Mt for other industrial uses.

In eastern Canada, domestic supplies of coal generally have to be augmented by imports of U.S. coal, mostly thermal coal, putting Canada in the unusual position of being both a major exporter and importer of coal. This paradox reflects transportation costs between mines and consumers and is one more example of the natural integration of U.S. and Canadian interest in mineral commodities; others include cement and gypsum.

Although Canada accounts for only about 2% of the world's coal production, it exports about one-half of its production, making it the world's fourth largest exporter after Australia, the United States, and the South Africa. During 1995, Canada shipped 34 Mt of coal to about 23

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different countries, with much of it going to the Pacific Rim countries and Brazil. Traditionally, more than 80% of Canada's coal exports has been coking coal, sold mostly to Japan; and about 70% of Canadian thermal coal exports were to Japan and the Republic of Korea.

Imports of coal into Canada during 1995 exceeded 9 Mt, slightly above the level of the year before. The United States furnished about 8 Mt of this coal, with the remainder from Colombia.

Natural Gas.—Canada ranked third in the world, after Russia and the United States, in output of natural gas. Increasingly, the production of natural gas has played a major role in the mineral economy of Canada and has had a palpable effect on GDP. In 1995, production rose to a gross output of 193 billion cubic meters (m^3), up from 183 billion m^3 in 1994, and production of marketable gas was 148 billion m^3. Marketable gas is gross (total) production minus reinjected gas and producer consumption. Canada exported about 79.3 billion m^3 (2.8 trillion cubic feet) of natural gas to the United States during 1995, which was about 10% of the U.S. supply. Gas exports to the United States were expected to increase to about 100 billion m^3 by 2006, anticipating the increasing inability of U.S. domestic production to meet demand. The Alberta Energy and Utilities Board projected the Province's natural gas reserves at the end of 1995 to be 1.489 trillion m^3 (52.5 trillion cubic feet), a net decline of 0.1% from the preceding year.

Opposition to natural gas exploration, production, and transmission has grown in recent years. Environmental groups opposed construction of proposed pipelines to feed demand in the United States, and the Rocky Mountain Ecosystem Coalition attempted to slow the expansion of natural gas exploration and production activities in northern Alberta.

Petroleum Crude.—Production of crude reached a record high of 662 million barrels (Mbbl) in 1995, more than 4% higher than in 1994 and between 17% and 18% higher than in 1991. Canada exported 380 Mbbl of crude to the United States in 1995.

After selling 30% of the integrated oil company Petro-Canada in 1991, the Government moved further ahead in privatization in 1995 by announcing the sale of much or most of the other 70%, with the aim of reducing its share to perhaps 20%. Petro-Canada was lauded as a model for state-owned oil company privatization[9] and seemed to be headed for expansion of its operations, after upgrading in terms of cost cutting and restructuring. Petro-Canada owned 25% of the immense Hibernia petroleum prospect offshore Newfoundland, and another 25% share in Terra Nova field in the Jeanne d'Arc basin adjacent to Hibernia, for which Petro-Canada can claim discovery. The Hibernia Field, offshore Newfoundland in 75 m of water is thought to contain 615 Mbbl of light waxy oil. The field was being developed in a $6.5-billion project by Petro-Canada plus a consortium of U.S.-based companies, including Mobil, Chevron, and Murphy, plus large subsidies from the Canadian Government. Production is scheduled to begin in 1997, with peak production estimated as high as 125,000 barrels per day (bbl/d)[10]

The Athabasca oil sands north of Fort McMurray, Alberta, played an increasingly important role in Canadian oil production. Output in 1995, in the form of a light sweet crude, was 25% of total Canadian output for the year. Technological development and increased operating efficiencies have steadily reduced production costs by the two major operators, Suncor Inc. and Syncrude Canada Ltd., at their two sites in Alberta and northern Saskatchewan. Suncor's operating costs at the Suncor oil sands plant in Alberta dropped from $15 per bbl in 1992 to below $12 per bbl in 1995, and a projected $9 per bbl in 1997. Hence, the crude from the Athabasca sands has sold for $6 or $7 more than the cost of production. Canada's National Energy Board predicted that the oilsands could contribute 50% of national production by 2010.

Athabasca, Peace River, and other bitumen and heavy oil deposits in Alberta amount to 2.5 trillion bbl of oil in place, about 40% of the world's known bitumen. The 300 billion bbl presently considered recoverable exceeds the 265 billion bbl of Saudi Arabia, but the latter can extract their oil for less than $1 per barrel. The Province of Alberta lowered its royalty on oil sand crude late in 1995, stipulating that it be 1% on all production until companies pay off capital costs and earn a return that matches interest rates for long-term bonds. They would then pay a 25% royalty on each barrel produced.

Reserves

Table 3 shows the levels of Canadian reserves of major minerals on or about January 1, 1995, in terms of metal contained in ore for the base and precious metals or in terms of recoverable quantities of other mineral commodities such as industrial minerals and mineral fuels. These mineral reserves represent "proven" and "probable" categories and exclude quantities reported as "possible." Reserves were defined as well delineated and economically minable ore from mines committed to production.

Other than for gold, reserves of major metals have fallen steadily from 1977 to 1995. During this period, gold reserves trebled from about 500 t to better than 1,500 t as rising prices, and the possibility of new price increases, provided strong incentive to exploration. Silver reserves, however, fell by one-third from about 31,000 tons to less than 20,000 tons during the same period.

Reserves of the leading base metals decreased conspicuously, led by molybdenum, which fell 60%, with lead down 57%, zinc falling 46%, copper retreating 44%, and nickel down 31% through the period in question. In each case the downtrend was not monotonic but varied

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positively as well as negatively. The absolute high values showed a clustering in 1980 to 1982 at a time when successful exploration had increased rapidly and extraction had not kept pace.

Yearly changes in assessment of reserves are, in simplest terms, the arithmetic result of (a) additions to reserves, (b) deletions of reserves, and (c) production. Additions are caused by exploration, discoveries, new technical information, and commodity price increases; deletions are caused by increases in mining costs, decreases in market prices, and unforeseen requirements for additional capital. Production is driven by the favorable balance between cost and return, which normally changes continually. Most mining operations aim at extracting the lowest grade ore that is profitable at prevailing prices for the product, thus not infrequently causing redefinition of the ore reserves. One further complication in Canada is that a large proportion of Canadian mines is polymetallic, necessitating close attention to market price and processing costs for two, or several, mineral commodities simultaneously to enable production as coproducts.

Reserves of major metals were distributed unevenly thoroughout Canada, influenced mostly by mineralization of the Precambrian shield, the Rockies (Cordillera), and the Coast Ranges. New Brunswick had more than half of lead reserves and roughly 40% of zinc and silver. Ontario had three-quarters of the nickel, about 57% of the gold, and slightly less than half of the copper. British Columbia had 100% of the molybdenum and about one-third of the copper. New reserves in discoveries yet to be made will alter the overall reserves relationship.

Infrastructure

With a total land area of about 9,221,000 km^2, slightly larger than the United States, Canada had networks of highly developed infrastructure as well as other vast areas of trackless wilderness. The country had 884,272 km of roads, comprising 250,023 km of paved highway, 462,913 km of gravel or other loose surface, and 171,336 km of earth-surface roads, the latter not graded or drained in many places. Bulldozed temporary roads have been established for mining exploration in many out-of-the-way places, but these deteriorated quickly where not maintained.

A total of 78,148 km of railroads included two main systems, the Canadian National and the Canadian Pacific. The country also had about 3,000 km of inland waterways, including the St. Lawrence Seaway, one of the busiest in the world, leading into the Great Lakes marking the boundary with the United States in many places. Principal Ports were Halifax; Montreal; Quebec; St. John (New Brunswick); St. John's (Newfoundland); Toronto; and, on the west coast, Vancouver. Canada's merchant marine comprised approximately 75 ships of 1,000 or more gross registered tons.

The country had 1,386 airports. Among these, 964 had permanent-surface runways; 17 had runways longer than 3,047 m; 16 had runways 2,438 to 3,047 m long; and 215 had runways 1,524 to 2,437 m in length; of the latter, 69 were unpaved. Civil aviation included about 636 major transport aircraft, with Air Canada as the major carrier.

Canada generated electrical power from coal, natural gas, and nuclear fuels as well as massive hydroelectric facilities. Total capacity was approximately 108 gigawatts. About 511 billion megawatt hours (MWh), or 18 MWh per capita, was produced in 1993, the last year for which complete data were available. More than 62% of Canada's electricity was generated by hydroelectric plants, about 17% by nuclear reactors, 15% by coal, and 6% by oil and gas. Quebec and Ontario produced the most electricity, 154 MWh and 141 MWh, respectively. Nearly 97% of Quebec's electricity came from hydroelectric plants, with the remaining 3% produced mainly by nuclear facilities. In contrast, about 56% of Ontario's electric power derived from nuclear plants, 29% from hydroelectric, and 14% from coal-fired plants. The majority of Canada's electricity exports originated in the eastern Provinces of Quebec, Ontario, and New Brunswick and were sold to consumers in New England and New York. The western Provinces of British Columbia and Manitoba also exported large amounts of electricity, mainly to Washington, Minnesota, California, and Oregon. Except for Alberta, all Canadian Provinces bordering the United States had transmission links to neighboring U.S. systems. Canadian electricity exports to the United States surged in late 1993 and early 1994, largely the result of favorable hydrological conditions. In November 1994, Québec announced cancellation of the controversial $10-billion Great Whale hydroelectric power project. Under discussion since the mid-1970's, Great Whale was dealt a severe setback when New York's Power Authority, a major Hydro-Quebec customer, announced cancellation of a $5-billion power contract, citing environmental concerns and decreased power needs.

An extensive system of pipelines connected oil-producing (mostly western Canada) and oil-consuming areas (mostly central and eastern Canada and the United States). This system was dominated by two major pipelines: the Interprovincial Pipe Line (IPL), which delivered oil from Edmonton east to Montreal, Quebec, and the U.S. Great Lakes region; and the Trans Mountain Pipe Line (TMPL), which delivered oil mainly from Alberta west to refineries and terminals in the Vancouver area, as well as to the Puget Sound area of Washington. Canadian natural gas was transported largely by TransCanada PipeLines Ltd. of Calgary, which owns 13,600 km of mainline gas pipelines in Canada, along with 56 compressor stations, linking western Canadian gas producers with eastern Canadian and

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U.S. consumers. In 1993, the TransCanada system shipped a record 60 billion m^3 of natural gas, up from 40 billion m^3 in 1989, including 25 billion m^3 to the United States. Total Canadian pipeline network included about 25,000 km for crude oil and refined products and 75,000 km for transmission of natural gas. Alberta's network represents the greatest length for any Province.[11]

Outlook

Canada's mineral industry was influenced by several positive factors in 1995. The first was an overall turnaround of the national economy after the Quebec secession vote, with new life in the credit markets, strengthening of the currency, curtailment of expenditures and downsizing in certain of the public sectors, rapidly increasing exports, and a better tone to equity markets. Second, in the midst of all of this, prices of base metals in world markets were stronger than they had been for some time, with firm demand in both Europe and Asia.

Third, but no less significantly, the Canadian petroleum industry just kept growing. Exploration and production reached new levels of activity; and Canada became an expanding exporter to the United States of crude, natural gas, and refinery products. After years of questions concerning the feasibility of the Hibernia offshore oil project, it was forging ahead in fine style with an implied promise of rich payoffs to come. Moreover, comparisons were heard between the Canadian offshore and the development of the now-legendary North Sea fields.

Fourth, and more important to the long view within the mineral industry, the huge nickel-copper-cobalt discovery at Voisey's Bay made a spectacular case for more exploration in Canada, no matter how attractive the situation in Latin America, Asia, or Australia. Furthermore, new prospects were found for gold in many parts of Canada; even though market pricing seemed to ignore the many predictions of great increases to come.

Fifth, and more difficult to assess or predict, was the concerted effort to reconcile conflicting interests in the formulation of policy concerning ownership, aboriginal issues, mining development, environmental constraints and remediation, social instabilities, and economic necessity in furthering the concept of sustainable development. Active engagement of these issues may help provide outcomes that would support the future of the mining industry.

Canada is well positioned in terms of its mineral-resource base and its access to the United States and other markets. Its mineral industry is primarily export oriented with as much as 90% of the production of some commodities going to foreign purchasers. The United States should continue to be a major market for Canada's metals and minerals. In this regard, the industry's export capability is enhanced significantly by a lower exchange rate for the Canadian dollar.

Some issues facing Canada's mineral industry remain complex. Many of them are international in nature and may lie beyond Canada's direct industrial or market influence, such as those involving Russia or China.

No country can escape the realities of growing international competition, especially from mineral-rich developing countries that have liberalized economic and political systems in order to attract foreign investment. But Canada's best asset may be its achievement of a popular concensus in support of sustainable development.

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[1]For more detailed information on the mineral industry of Canada, see the Canadian Minerals Yearbooks for 1994 and 1995, prepared by the Mining Sector, Natural Resources Canada, Ottawa, Canada, which were used extensively as source material for this report. The U.S. Department of the Interior, U.S. Bureau of Mines, has arranged to have these Canadian publications placed in selected depository libraries of the 50 States and Puerto Rico. Please note that any datum or statistic in the text not referenced elsewhere may be assumed to be from either the Yearbook or the related series of separate, preliminary, topical periodicals containing information compiled by Statistics Canada and issued by Natural Resources Canada.

[2]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at an average rate of CAN$1.3727=US$1.00 for 1995. All values in this report are expressed in U.S. dollars.

[3]Simon, Bernard. Financial Times, London. (United Kingdom), Jul y 1, 1996, p. 15.

[4]Natural Resources Canada. Sustainable Development and Minerals and Metals, Feb. 12, 1996.

[5]Pilsworth, Diana, and Kokkinos, Kosta. General Review: The Canadian Economy (1995), Natural Resources Canada, Mar. 1996.

[6]Falconbridge Ltd. 106 Million Tons and Counting, supplement to the Canadian Mining Journal, June 1996, p.13.

[7]Diamond Fields Resources Inc. Annual Report 1995, 200 Burrard St., Vancouver, British Columbia.

[8]Roy, Robert. Oh Canada, International Report, International Cement Review, Aug.1995, p. 24.

[9]Oil and Gas Journal. Petro-Canada Emerging as a Model of State Oil Company privatization, Dec. 25, 1995, p. 21..

[10]U.S. Department of Energy, Energy Information Administration. Canada Country Analysis Briefs: 1995.

[11]Work cited in footnote 11.

Major Sources of Information

Natural Resources Canada
580 Booth Street
Ottawa, Ontario K1A 0E4
Canada
Mining Sector
Geological Survey of Canada
Surveys, Mapping, and Remote Sensing Sector
Canada Centre for Mineral and Energy Technology (CANMET)
Statistics Canada
Tunney's Pasture
Ottawa, Ontario
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Ottawa, Ontario K1A 0H4
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Yukon Chamber of Mines
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Whitehorse, Yukon Territory 1A 3T5
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840 West Hastings St.
Vancouver, British Columbia V6C 1C8
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Montreal, Québec H3A 2M8
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Québec G1V 4W2
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The New Brunswick Mining Association
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Moncton, New Brunswick E1C 1W1
Canada

Chamber of Mineral Resources of Nova Scotia
202-5525 Artillery Place
Halifax, Nova Scotia NS B3J 1J2
Canada

Major Publications

Canadian Geoscience Council, annual report.
Canadian Institute of Mining and Metallurgy, monthly.
Canadian Mineral Analysts, monthly.
Canadian Mining Journal, Canada's Top Mining Companies, monthly.
Natural Resources, Canada:
Canadian Minerals Yearbook, annual.
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TABLE 1
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	1,131	1,104	1,182	1,170	1,064
Primary: metal		1,821,642	1,971,843	2,308,868	2,250,000	2,171,992
Antimony 3/		469	948	673	540 r/	789
Arsenic trioxide e/		236 4/	250	250	250	250
Bismuth 3/		65	224	144	129 r/	126
Cadmium:						
Mine output, Cd content 3/		1,787	1,630	1,340	1,500 r/	1,783
Metal, refined		1,829	1,963	1,944 r/	2,173 r/	2,360
Calcium	kilograms	W	W	W	W	W
Cobalt:						
Mine output, Co content 3/		5,274	5,102	5,108	4,265 r/	5,266
Metal:						
Shipments 5/		2,171	2,223	2,150	1,846 r/	2,148
Refined, including oxide		2,248	2,210	2,695	2,950	3,092
Columbium and tantalum:						
Pyrochlore concentrate:						
Gross weight		5,230	5,100	5,320	5,130	5,230
Cb content		2,354	2,295	2,393	2,310	2,353
Tantalite concentrate:						
Gross weight		373 r/	193 r/	102 r/	144 r/	104
Ta content		93	48	25	36 r/	26
Cb content		19 r/	10 r/	5	7 r/	5
Copper:						
Mine output, Cu content 3/		811,134	768,582	733,606	590,863 r/	728,678
Metal:						
Smelter:						
Primary, blister		505,425	515,028	518,301	515,088	522,467
Secondary and scrap		26,757	37,408	44,059	45,445 r/	90,929
Total		532,182	552,436	562,360	560,533 r/	613,396
Refined:						
Primary		538,339 r/	539,302 r/	561,580 r/	549,869 r/	468,897
Secondary		34,500	31,100	41,600	45,000	91,100
Total		572,839 r/	570,402 r/	603,180 r/	594,869 r/	559,997
Gold, mine ouput	kilograms	176,552	161,402	152,929	146,428	150,273
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	39,307 r/	33,167 r/	31,830 r/	37,703 r/	38,560
Fe content	do.	24,920 r/	21,183 r/	19,990 r/	24,235	24,561
Metal:						
Pig iron	do.	8,268	8,621	8,633	8,150	8,464
Direct reduced iron	do.	553	639	758	770	780 e/
Ferroalloys, electric arc furnace: e/						
Ferromanganese and silicomanganese	do.	45	--	--	--	--
Ferrosilicon	do.	75	55	55	55	56
Silicon metal	do.	20	20	20	20	22
Ferrovanadium	do.	2	2	2	2	1
Total	do.	142	77	77	77	79
Crude steel	do.	12,987	13,933	14,387	13,897	14,415
Lead:						
Mine output, Pb content		276,528 r/	343,808	182,234 r/	167,584 r/	210,415
Metal, refined:						
Primary		106,420	151,252	147,907 r/	153,035 r/	173,731
Secondary		105,948	101,633	69,107	98,605 r/	103,641
Total		212,368	252,885	217,014 r/	251,640 r/	277,372
Lithium: spodumene e/		12,000	18,500	18,900	20,000	21,000
Magnesium metal, primary e/		35,512 4/	25,800	23,000	28,900	41,900 e/
Molybdenum, mine output, Mo content		11,329	9,405	9,699	9,188 r/	9,535

See footnotes at end of table.

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TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS--Continued						
Nickel:						
Mine output, Ni content 3/		192,259	186,384	188,080	149,886	180,984
Refined 6/		131,500	135,200	123,139	105,144	121,523
Platinum-group metals, mine output	kilograms	11,708	11,907	12,441	14,313 r/	15,904
Selenium, refined 7/	do.	207,286	294,057	500,000 e/	566,000 r/	553,000
Silver:						
Mine output, Ag content	do.	1,338,799	1,215,388	895,837	767,842 r/	1,244,992
Refined	do.	1,001,722	1,027,965	1,011,956	915,128 r/	1,002,708
Tellurium, refined 7/	do.	12,374	21,776	24,000	42,000 r/	91,000
Tin:						
Mine output, Sn content		4,455	--	--	-- e/	--
Metal, smelter, secondary e/		200	200	200	200	--
Titanium: Sorel slag 8/		701,000	753,000	653,000	764,000	815,000
Uranium oxide (U_3O_8)		9,624	10,965	10,795	11,372 r/	12,404
Zinc:						
Mine output, Zn content		1,156,582	1,324,675	1,004,367	1,010,712 r/	1,111,497
Metal, refined, primary		660,552	671,702	659,881 r/	690,965 r/	720,145
INDUSTRIAL MINERALS						
Asbestos		639,008	590,641	522,967 r/	531,000 r/	515,587
Barite		50,000	37,000	59,000	55,000	57,000
Cement, hydraulic 9/	thousand tons	9,370	8,590	9,390	10,584 r/	10,722
Clay and clay products 10/	value, thousands	$119,838	$117,326	$120,000 e/	$120,000 e/	$98,876
Diatomite e/		8,000	10,000	10,000	10,000	10,000
Gemstones, amethyst and jade		542	1,335	3,680	1,212 r/	1,593
Graphite (exports)		6,200	17,400	18,800	21,711 r/	22,000
Gypsum and anhydrite	thousand tons	6,830	7,566	7,880	8,500	7,956
Lime 9/	do.	2,375	2,380	2,380	2,390	2,567
Magnesite, dolomite, brucite e/		180,000	180,000	180,000	180,000	180,000
Mica, scrap and flake e/		17,000	17,500	17,500	17,500	17,500
Nepheline syenite		484,000	554,000	550,000	602,000 r/	616,000
Nitrogen: N content of ammonia		3,016,247	3,104,119	3,410,000	3,470,000	3,773,000
Potash, K_2O equivalent	thousand tons	7,406	7,270	6,841	8,517 r/	9,007
Pyrite and pyrrhotite, gross weight e/		5,000	5,000	5,000	5,000	5,000
Salt	thousand tons	11,993	11,171	10,900	11,700	10,893
Sand and gravel	do.	214,410	238,134	237,000	247,148 r/	240,189
Silica (quartz) 11/	do.	1,495	1,754	1,600 e/	1,600 e/	1,650
Sodium compounds, n.e.s.:						
Sodium carbonate (soda ash) e/	do.	310	305	305	300	300
Sodium sulfate, natural 12/	do.	332	282	320	317 r/	311
Stone 13/	do.	102,986	104,549	106,000	110,411 r/	111,404
Sulfur, elemental byproduct:						
Metallurgy	do.	872	931	900 r/	870 r/	860
Natural gas	do.	5,488	5,769	6,600 r/	7,000 r/	7,100
Petroleum e/	do.	230	235	340 r/	350 r/	380
Tar sands	do.	540	552	590 r/	630 r/	670
Total	do.	7,130	7,487	8,430 r/	8,850 r/	9,010
Talc, soapstone, pyrophyllite	do.	123	104	108	130	116
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		157,115	161,218	161,000 e/	160,000 e/	165,000
Coal:						
Bituminous and subbituminous	thousand tons	62,149	55,600	59,000	62,700	64,176
Lignite	do.	9,000	10,027	10,000	10,100	10,740
Total	do.	71,149	65,627	69,000	72,800	74,916
Coke, high-temperature	do.	3,622	3,711	3,657	3,684	3,283
Gas, natural:						
Gross	million cubic meters	144,987	158,067	171,000	183,000	192,530
Marketed	do.	105,201	117,000	129,000	139,000	148,204

See footnotes at end of table.

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TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
MINERAL FUELS AND RELATED MATERIALS--Continued						
Natural gas liquids:						
Pentanes plus	million cubic meters.	43,392	48,069	50,500	55,900	56,450
Condensate	do.	1,217	1,396	1,430	1,730	2,323
Total	do.	44,609 r/	49,465 r/	51,930 r/	57,630 r/	58,773
Peat		856,000	740,000	801,000	914,000 r/	1,010,000
Petroleum:						
Crude 14/	thousand 42-gallon barrels	563,985	585,076	610,000	636,000	662,110
Refinery products:						
Liquefied petroleum gas, propane, butane, and naphtha	do.	16,538	17,293	15,800	14,900	13,745
Gasoline:						
Aviation	do.	759	706	824	835	846
Other	do.	229,665	229,316	234,000	239,000	243,455
Petrochemical feedstocks	do.	31,942	30,721	29,400	28,200	33,554
Jet fuel	do.	28,592	24,668	26,600	26,800	29,315
Kerosene	do.	3,493	2,015	3,670	2,690	5,470
Distillate fuel oil, diesel and light	do.	169,184	163,159	178,000	186,000	183,597
Lubricants including grease	do.	6,176	5,363	5,360	6,250	5,807
Residual fuel oil, heavy	do.	54,081	50,131	48,500	44,200	41,352
Asphalt	do.	15,922	15,221	17,800	20,400	20,048
Petroleum coke	do.	5,692	6,310	7,220	6,660	6,961
Unspecified	do.	30,791	30,322	28,900	28,100	24,271
Refinery fuel and losses 15/	do.	24,697	29,140	24,800	25,100	37,583
Total	do.	617,532	604,365	620,874	629,135	649,779

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Data published for 1990 through 1994 in the preceding year were rounded by the U.S. Bureau of Mines to three significant digits. With very few exceptio data in the present table have been unrounded to their original state.
2/ Table includes data available through July 1995.
3/ Metal content of concentrates produced.
4/ Reported figure.
5 Cobalt content of all products derived from Canadian ores, including cobalt oxide shipped to the United Kingdom for further processing and nickel-copper-cobalt matte shipped to Norway for refining.
6/ Nickel contained in products of smelters and refineries in forms which are ready for use by consumers. Natural Resources Canada has revised all nickel re figures to conform with International Nickel Study Group guidelines.
7/ From all sources, including imports and secondary sources. Excludes intermediate products exported for refining.
8/ Refined Sorel slag contains 80% titanium dioxide.
9/ Producers' shipments and quantities used by producers.
10/ Includes bentonite products from common clay, fire, stoneware clay, and other clays. Values are in current Canadian dollars.
11/ Producers' shipments of quartz.
12/ Excludes byproduct production from chemical plants.
13/ Crushed, building, ornamental, paving, and similar stone.
14/ Including synthetic crude (from oil shale and/or tar sands).
15/ Refinery fuel represents total reported production of still gas, including a small amount sold.

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TABLE 2
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Alcan Aluminum Ltd.	Smelter, Laterriere, Quebec	204.
Do.	do.	Smelter, Isle-Maligne, Quebec	73.
Do.	do.	Smelter, Beauharnois, Quebec	48.
Do.	do.	Smelter, Shawinigan, Quebec	84.
Do.	do.	Smelter, Grande-Baie, Quebec	180.
Do.	do.	Smelter, Arvida, Quebec	232.
Do.	do.	Smelter, Kitimat, British Columbia	272.
Do.	Aluminiere de Becancour Inc. (Pechiney Corp., 25%; Quebec Government, 24.95%)	Smelter, Beacancour, Quebec	360.
Do.	Canadian Reynolds Metals Co. Ltd. (Reynolds Metals Co., 100%)	Smelter, Baie-Comeau, Quebec	400.
Do.	Aluminerie Alouette Inc. (Vereinigte Aluminium-Werke AG, Germany, 20%; Hoogovens Groep BP, Netherlands, 20%; Metall Aktiengesellshaft, Austria, 20%; SGF, Alunor, 20%; Marubeni, Italy, 16.3% Kobe Steel, Japan, 3.7%)	Smelter, Sept-Iles, Quebec	215.
Do.	Aluminerie Lauralco Inc. (Alumax Inc. of the U.S.)	Deschambault, Quebec	215.
Asbestos	Lac d'Amiante du Quebec, Ltee (LAQ) (Jean Dupere, President of LAB Chrysotile, Inc.; Connell Bros. Co. Ltd.)	Black Lake, Quebec	160 (fiber).
Do.	Asbestos Corp. Ltd. (Mazarin Mining Exploration Inc.)	British Canadian Mine, Black Lake, Quebec	70 (fiber).
Do.	Bell Operations. (Mines D'Amiante Bell)	Thetford Mines, Quebec	70 (fiber).
Do.	JM Asbestos Inc.	Jeffrey Mines, Asbestos, Quebec	250 (fiber).
Do.	Teranov Mining Corp. (Black Hill Minerals Ltd., 50%; Cliff Resources, 50%)	Baie Verte, Newfoundland	20 (fiber).
Cement	Lafarge Canada Inc.	Bath, Ontario	1,045 (dry-process).
Do.	do.	Exshaw, Alberta	1,029 (dry-process).
Do.	do.	Kamloops, British Columbia	194 (dry-process).
Do.	do.	Richmond, British Columbia	474 (wet-process).
Do.	do.	St. Constant, Quebec	991 (dry-process).
Do.	do.	Brookfield, Nova Scotia	527 (dry-process).
Do.	St. Lawrence Cement Inc. (Independent Cement Inc.)	Joliette, Quebec	991 (dry-process).
Do.	do.	Mississauga, Ontario	1,876 (wet and dry).
Do.	do.	Beauport, Quebec	611 (wet-process).
Do.	ESSROC Canada Inc.	Picton, Ontario	1,124 (dry-process).
Do.	North Star cement Ltd.	Corner Brook, Newfoundland	152 (dry-process).
Do.	Ciment Quebec Inc.	St. Basile, Quebec	1,074 (wet and dry).
Do.	Federal White Cement Ltd.	Woodstock, Ontario	170 (dry-process).
Do.	St. Marys Cement Co.	Bowmanville, Ontario	1,550 (dry-process).
Do.	do.	St. Marys, Ontario	645 (dry-process).
Do.	Inland Cement Ltd. (S.A. Cimenteries CBR)	Edmonton, Alberta	726 (dry-process).
	Tilbury cement Ltd. (S.A. Cimenteries CBR)	Delta, British Columbia	1,040 (dry-process).
Coal	Quinsam Coal Corp. (Hillsborough Resources Ltd. 63%; Marubeni Corp. 33%; remainder unknown 4%)	Quinsam Coal Mine, Campbell River, British Columbia	14,400 (open pit and underground).
Do.	Cape Breton Development Corp. (Government of Canada, 100%)	Sydney, Nova Scotia	22,000 (longwall).
Do.	Luscar, Ltd.	Obed Mountain Mine, Hinton, Alberta	3,500.
Do.	Gregg River Resources Ltd. (Gregg River Coal 60%; 7 Japanese Cos. 40%)	Gregg River Mine, Hinton, Alberta	3,960 (open pit).
Do.	Manalta Coal Ltd. (Transalta Utilities Corp.)	Highvale Mine, Seba Beach, Alberta	11,610 (open pit).
Do.	Smoky River Coal Ltd. (Smoky River Holdings Ltd., 100%)	Grande Cache, Alberta	3,600 (open pit and underground).

See footnotes at end of the table.

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TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper	Broken Hill Proprietary Co. Ltd. (BHP Holdings Inc. 100%)	Island Copper Mine, Port Hardy, British Columbia	16,200.
Do.	Cassiar Mining Corp. (Princeton Mining Corp. 100%)	Similco Mine, Princeton, British Columbia	9,000.
Do.	Falconbridge Ltd. (Noranda Inc. 50%; Trelleborg AB, 50%)	Sudbury Operations, Sudbury, Ontario	4,250.
		Strathcona and Timmins Operations, Timmins, Ontario	4,860.
Do.	do.	Smelter, Timmins, Ontario	440.
Do.	Gibraltar Mines Ltd.	McLease Lake, British Columbia	13,070.
Do.	Highland Valley Copper (Cominco, 50%; Rio Alom Ltd., 33.6%; Teck Corp., 13.9%; and Highmont Mining Co., 2.5%)	Logan Lake, British Columbia	4,500.
Do.	Inco Ltd.	Sudbury and Shebandowan, Ontario Thompson District, Manitoba	20,250 (mine).
Do.	do.	Smelter, Sudbury, Ontario	500.
Do.	do.	Refinery, Sudbury, Ontario	170.
Do.	Noranda Inc.	Bell Copper Mine, Babine Lake, British Columbia	5,550 (mine).
Do.	do.	Smelter Home, Noranda, Quebec	770.
Gold	Barrick Gold Corp.	Holt-McDermott Mine, Harker Twp., Ontario	405 (ore).
Do.	do.	Bosquet Mines 1 and 2, NW Quebec	954 (ore).
Do.	do.	Doyon Mine, NW Quebec	1,323 (ore).
Do.	do.	Golden Patricia Mine, Pickle Lake, Ontario	156 (ore).
Do.	do.	Macassa MIne, Teck Twp. N. Ontario	473 (ore).
Do.	Princeton Mining Corp.	Similco Mine, Princeton, British Columbia	450 (kilograms metal).
Do.	Echo Bay Mines Ltd.	Lupin Mine, Contwoyo Lake; Northwest Territories	612.
Do.	Royal Oak Mines Inc.	Giant Mine, Yellowknife, Northwest Territories	407 (ore).
Do.	do.	Giant Mill--tailings, Yellowknife, Northwest Territories	3,265 (ore).
Do.	do.	Pamour, Ontario	945 (ore).
Do.	do.	Hope Brook Mine, Conteau Bay, Newfoundland	1,090 (ore).
Do.	Hemlo Gold Mines Inc. (Noranda Inc.,44.1%)	Golden Giant Mine, Hemlo, Ontario	1,080 (ore).
Do.	Placer Dome Inc.	Campbell Mine, Red Lake, Ontario	400 (ore).
Do.	do.	Detour Lake Mine, Northeast Ontario	900 (ore).
Do.	do.	Dome Mine, South Porcupine, Ontario	1,300 (ore).
Do.	do.	Sigma Mine, Val d'Or, Quebec	500 (ore).
Do.	do.	Kiena Mine, Val d'Or, Quebec	500 (ore).
Do.	Teck-Corona Corp. (Teck Corp., 100%)	David Bell Mine, Hemlo, Ontario	456 (ore).
Gypsum	Domtar Inc.	Flat Bay, Newfoundland	1,300.
Do.	Georgia-Pacific Corp.	River Denys, Sugar Camp, Nova Scotia	1,460.
Do.	Little Narrows Gypsum Co. Ltd. (USG Corp., 100%)	Little Narrows, Nova Scotia	1,640.
Do.	National Gypsum (Canada) Ltd. (Aancor Holdings Corp., 100%)	Milford, Nova Scotia	3,300.
Do.	Westroc Industries Ltd.	Windermere, British Columbia	1,170.
Iron and steel	Iron Ore Co. of Canada (Dofasco 6.9%)	Carol Lake, Labrador	8,800 (concentrate), 10,300 (pellets).
Do.	Quebec Cartier Mining Co. (Dofasco Inc., 50%)	Mount Wright, Quebec	16,950 (concentrate), 7,500 (acid pellets).
Do.	The Algoma Steel Corp. Ltd. (Dofasco Inc., 100%)	Sault Ste. Marie, Ontario	2,478 (pig iron), 3,135 (crude steel), 657 (sinter).
Do.	Dofasco Inc.	Hamilton, Ontario	3,642 (pig iron), 4,500 (crude steel).
Do.	Stelco, Inc.	do.	2,733 (pig iron), 7,990 (crude steel), 560 (sinter).

See footnotes at end of the table.

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TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel--Continued		Wabush Mines Ltd. (Inland Steel Co. 15.1%; A Steel 15.1%; Stelco Inc. 37.9%; Dofasco Inc. 24.2%; Inland Steel Co. 15.1%; Acme Steel Co. 15.1%; Cliffs Mining Co. 7.7%)	Wabush, Labrador, and Pointe Noire, Quebec	6,200 (concentrate).
Lead		Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 63.3%)	No. 12 Mine, Bathurst and smelter in Belledune, New Brunswick	72 (Pb contained).
Do.		Hudson Bay Mining and Smelting Co., Ltd. (Minorco, 100%)	Flin Flon and Snow Lake, Manitoba	60 (Pb-Zn contained).
Do.		Cominco Ltd. (Teck Corp. 36.34%)	Trail, British Columbia	95 (refined lead).
Do.		do.	Sullivan Mine, Kimberly, British Columbia	3,600 (ore).
Do.		do.	Polaris Mine, Cornwallis Island, Northwest Territories	1,000 (ore).
Do.		Conwest Eploration Co. Ltd.	Nanisivik Mine, Baffin Island, Northwest Territories	785 (ore).
Do.		Anvil Range Mining Corporation	Faro Mine, Yukon Territory	184 (Pb-Zn contained).
Limestone		Lafarge Canada Inc.	Steep Rock, Manitoba	906 (quarry).
Do.		Scotia Limestone Ltd.	Iris Cove, Sydney, Nova Scotia	720.
Do.		Inland Cement Ltd. (CBR Materials Corp.	Cadoman, Alberta	2,160.
Do.		do.	Cadomin, Alberta	2,160 (quarry).
Do.		Havelock Co.(Kickenson Mines Co. (100%)	Havelock, New Brunswick	864 (limestone).
Do.		Continental Lime Ltd.	Faulkner, Manitoba	1,440 (crushed stone).
Nickel		Falconbridge Ltd. (Noranda Inc., 46.4% Underwriting syndicate 28.3%)	East, Fraser, Lockerby, Onaping, Strathcona, and Craig in Sudbury	30 (metal contained).
Do.		do.	Smelter, Falconbridge	45 (rated capacity).
Do.		Inco Ltd.	Sudbury, Ontario, district mines: Frood, Stobie, Little Stobie, Creighton, Copper Cliff North and South, Garson-Offsets, Levack, McCreedy East and West, Coleman, Crean Hill, Murray, and Totten in Sudbury area, Ontario; also Shebandowan mine in Western Ontario	106 (metal contained).
Do.		do.	Smelter, Sudbury, Ontario	110 (metal contained).
Do.		do.	Refinery, Sudbury, Ontario	57 (metal contained).
Do.		do.	Refinery, Port Colborne, Ontario	30 (metal contained).
Do.		do.	Thompson, Pipe, Birchtree mines in Manitoba	62 (metal contained).
Do.		do.	Smelter, Thompson, Manitoba	82 (metal contained).
Do.		Sherritt Gordon Ltd.	Refinery, Fort Saskachewan, Alberta	24 (metal contained).
Petroleum: 1/				
Gas	million cubic meters	BP Canada Inc. (The British Petroleum Co. PLC London, 100%)	Noel Area, North Alberta; Chauvin, Sibbald, North Pembina, Alberta	47.
Crude	million 43-gallon barrels	do.	do.	12.
Do.	do.	Gulf Canada Corp. (Olympia & York Developments, 80%; Gulf, 20%)	Fenn-Big Valley, Swan Hills, Goose River, Peerless, and Sene, Alberta	18.
Do.	do.	Home Oil Co. Ltd. (Interhome Energy Inc. 100%)	Red Earth, Garrington, Cherhill, Medicine River, and Swan Hills, Alberta	11.5.
Gas	billion cubic meters	do.	do.	1.8.
Crude	thousand 42-gallon barrels	Imperial Oil Ltd. (Exxon Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta, Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	670.
Gas	million cubic meters	do.	do.	36.4.
Crude	million 42-gallon barrels	Mobil Oil Canada Ltd. (Mobil Corp., United States, 100%)	Hibernia, Grand Banks, Southeast of Newfoundland and Sable Island, Nova Scotia, and others in Alberta	26.1.
Gas	billion cubic meters	do.	do.	3.0.
Crude	million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%; Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.1.
Do.	do.	Oakwood Petrooleums Ltd. (Sceptre Resources Ltd., 100%)	Grantham, Hays Ronalane, Peace River, Normandville, Randell, Alberta, and Grizzly Valley, British Columbia	24.6.

See footnotes at end of the table.

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TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum--Continued:			
Crude million 42-gallon barrels	PanCanadian Petroleum Ltd. (Canadian Pacific Enterprises, 87%; others, 13%)	Rycroft, Wembley, Elk Point, Rio Bravo, Alberta	19.7.
Gas billion cubic meters	do.	do.	3.53.
Crude million 42-gallon barrels	Shell Canada Ltd. (Shell Investments, 79%; others, 21%)	Dimsdale, Little Smoky Lake, Sousa, Alberta, Midale, Benson, Saskatchewan	22.2.
Gas billion cubic meters	do.	do.	6.53.
Crude million 42-gallon barrels	Suncor Inc. (Sun Co. Inc., United States, 75%; Ontario Energy Resources, 25%)	Kidney, Zama Lake, Cosway, Albersun Prevo, and Medicine River, Alberta, and Leitchville, Unwin, Saskatchewan	4.1.
Crude thousand 42-gallon barrels	Texaco Canada Petroleum Inc. (Texaco Inc., United States, 78%; others, 22%)	Eaglesham, Virgo, Alberta, and Desan, British Columbia	158.
Gas million cubic meters	do.	do.	67.3.
Crude million 42-gallon barrels	UNOCAL Canada Ltd. (UNOCAL Corp., United States, 100%)	Calgary, Alberta	14.7.
Potash (K_2O equivalent):	Potash Corp. of Saskatchewan Inc. (Private, 37%; Provincial government, 63%)	Lanigan, near Lanigan Saskatchewan	3,400 (KCl).
Do.	do.	Rocanville, southeast Saskatchewan	1,750 (KCl).
Do.	International Minerals & Chemical Corp. (Canada) Ltd. (IMC Fertilizer Corp., 100%)	Esterhazy, southeast Saskatchewan	1,814 (KCl).
Do.	Kalium Chemicals (Kalium Canada Ltd.,	Potash Mine, Moose Jaw, Saskatchewan	2,040 (KCl).
Salt and brine operations	The Canadian Salt Co.	Pugwash, Nova Scotia	1,400 (rock salt and brine salt).
Do.	do.	Iles-de-la-Madeleine, Quebec	1,625 (rock salt).
Do.	do.	Ojibway, Ontario	2,600 (rock salt).
Silver	Prime Resources Group	Eskay Creek Mine, British Columbia	227.
Do.	Equity Silver Mines Ltd. (Placer Dome Inc., 58.8%)	Houston, British Columbia	2,970 (Ag-Au-Cu concentrate).
Do.	Faro Mine (Anvil Range Mining Corp. 100%)		4,745 (Pb-Zn-Ag-Au mill feed).
Do.	LAC Minerals Ltd.	Macassa Mine, Ontario	165 (mill feed).
Do.	do.	Bousquet Mine, Quebec	580 (mill feed).
Do.	Similco Mines Ltd.	Princeton, British Columbia	8,250 (Ag-Au-Cu concentrate).
Sodium chlorate production using salt	Dow Chemical Canada Inc. (The Dow Chemical Co. Michigan, United States, 100%)	Fort Saskatchewan, Alberta	524 (caustic soda).
Do.	do.	Sarnia, Ontario	350 (caustic soda).
Do.	General Chemical Canada Ltd.	Amherstburg, Ontario	363 (sodium carbonate).
Sulfur:			
Petroleum refinery capacities	Consumer's Cooperative Refineries Ltd. (Federated Cooperatives Ltd., 100%)	Regina, Saskatchewan	54.
Do.	Esso Petroleum Canada	Sarnia, Ontario	50.
Do.	Sulconam Inc. (Petro Canada, 7.6%)	Montreal, Quebec	108.
Main sulfur extraction plants (sour gas and oil sands)	Amoco Canada Petroleum Co., Ltd. (Amoco ' Corp. USA, 100%)	East Crossfield-Elkton, Alberta	650.
Do.	Canadian Occidental Petroleum, Ltd.	East Calgany-Crossfield, Alberta	610.
Do.	Chevron Canada Resources Ltd. (Chevron Corp. USA, 100%	Kaybob South III, Alberta	1,281.
Do.	Husky Oil Ltd.	Ram River, Ricinus, Alberta	1,646.
Do.	Shell Canada Ltd.	Waterton, Alberta	1,120.
Principal SO_2 and H_2SO_4 production capacities	Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H_2SO_4).
Do.	INCO Ltd.	Copper Cliff, Ontario	950 (H_2SO_4).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H_2SO_4).
Do.	ESSO Chemical Canada (Imperial Oil, Ltd., 100%)	Redwater, Alberta	910 (H_2SO_4).
Uranium	Stanleigh Mine (Rio Algom Ltd. 100%)	Elliot Lake, Ontario	815 (metal).
Do.	Cameco Corp. (Province of Saskatchewan, 61.5%; Government of Canada, 38.5%)	Key Lake, Saskatchewan	4,976 (metal).

See footnotes at end of the table.

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TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 63.3%)	Bathurst, New Brunswick	232 (Zn in concentrate).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Timmins Operations, Ontario	212 (Pb-Zn contained).
Do.	do.	Smelter	133 (slab zinc).
Do.	Hudson Bay Mining and Smelting Co., Ltd. (Minorco, 100%)	Snow Lake concentrator, Manitoba	1,125 (Pb-Zn ore).
Do.	do.	Flin Flon mine and smelter	85 (slab zinc).
Do.	Cominco Ltd. (Teck Corp, 36.34%)	Sullivan Mine, Kimberley, British Columbia	70 (Pb-Zn contained).
Do.	do.	Smelter, Trail, British Columbia	300 (slab zinc).
Do.	Anvil Range Mining Corp. (100%)	Faro Mine, Yukon Territory	184 (Pb-Zn contained).

1/ Projections of annual capacity involve matching decline curves against later discoveries and are generalized extrapolations only, based on data presented in Oil and Gas Handbook, 1991 and subsequent years, Northern Miner Press, Inc. Ownership of various companies, and proportionate participation in various leaseblocks and/or joint ventures, changes continually. The ownership proportions shown here must be considered illustrative only.

TABLE 3
CANADA: RESERVES OF MAJOR MINERALS IN 1995

(Thousand metric tons unless otherwise specified) 1/

Commodity		Reserves	
Abestos, fiber		39,000	e/
Coal, all types		6,365,000	e/
Copper, metal content		9,533	
Gold, metal	metric tons	1,513	2/
Gypsum		500,000	e/ 4/
Iron ore, iron content		1,305,000	e/
Lead metal content		3,861	
Molybdenum, metal content		148	
Natural gas	billion cubic meters	2,100	e/
Nickel, metal content		5,334	
Petroleum crude	million barrels	6,775	e/
Potash, K_2O equivalent	million tons	14,500	e/
Salt		315,000	3/
Silver metal	metric tons	19,146	
Sodium sulfate		91,500	3/
Sulfur		145,000	e/
Uranium		280	4/
Zinc metal content		14,514	

e/ Estimated.
1/ 1994 and 1993 Canadian Minerals Yearbook, Natural Resources Canada, unless noted.
2/ Excludes metal in placer deposits.
3/ Data in thousand short tons.
4/ Recoverable at prices of $100 per kilogram of U, or less.

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THE MINERAL INDUSTRY OF

CHILE

By Pablo Velasco

In 1995, Chile continued to be the world's top producer and exporter of copper (in terms of volume and value) producing 35% of the world's new mined copper. Chile also was recognized by the world mining community as the single most active mining country in the world in terms of new development and investment.

The strong performance of the copper subsector affected production in the molybdenum, gold, and silver subsectors, which also increased at the rates 15.9%, 10.1%, and 5%, respectively. Chile was also one of the world's significant producers and exporters of potassium nitrate and sodium nitrate and ranked second after the United States in world production of iodine, lithium, molybdenum, and rhenium.

According to government officials, in 1995, the Chilean economy had its best year in a decade in 1995. The economy registered growth of the gross domestic product (GDP) of 8.2% to about $62 billion;[2] and investment reached 31% of GDP, the eighth highest annual investment rate in the past 36 years. Per capita income increased by 6.4% to about $4,700. The improvement in the economy in 1995 was due mainly to the strong price of copper, which averaged $1.33 per pound compared with $1.05 per pound in 1994.

New foreign investment; the increase in output from the private sector's Cerro Colorado, Quebrada Blanca, La Candelaria, Ivan-Zar, and Zaldivar Mines; and the new expansion of the giant La Escondida Mine, with its new copper cathode plant capable of producing 80,000 metric tons per year (t/yr) of high-grade copper were largely responsible for the continued growth in 1995. Following an additional $520 million investment, La Escondida was expected to increase production to 800,000 t/yr by 1997, making it (in terms of production) the largest copper mine in the world.

According to the Chilean Copper Commission (COCHILCO), most of the foreign investment in the country mining sector was concentrated during the last 7 years in 20 projects shown in table 3. Some of these projects were recently initiated; others were already in production or in advanced stages of construction.

Government Policies and Programs

Significant political and economic reforms carried out in Chile during the 1970's and 1980's consolidated the country as a market economy. The transformation of Chile's economy became a model for policymakers in other Latin American nations.

In 1995, two laws regulated foreign investment in Chile. One was Decree Law No. 600 of 1974, which was amended in 1977 and reformed in 1993. This law, also referred to as the "Foreign Investment Statute," established a standard that became the model for many countries in Latin America and was the benchmark for foreign investment legislation in Chile. The second law was Title I, Chapter XIX (Compendium of Foreign Exchange Rules, issued by the Central Bank of Chile). As stipulated by this law, foreign investors, either as individuals or corporations, may use Chilean foreign-debt titles, payable abroad and maturing within 365 days, to invest in the country. This law provided the legal framework guaranteeing the rights of foreign investors and established maximum tax rates, offshore accounts, and a minimum period after which profits and capital could be repatriated.

The Government of Chile made protecting the environment a priority. A new Environmental Framework Law known as the Basic Law on the environment, was signed by the President of Chile on March 1, 1994. This law established legally the National Commission on the Environment, Comision Nacional del Medio Ambiente (CONAMA), and 12 Regional Environmental Commissions, Comisiones Regianales del Medio Ambiente (COREMA') to coordinate environmental protection activities among governmental agencies. The commissions would oversee developing and coordinating environmental policies and setting up modern tools for the implementation and enforcement of these policies. The most important environmental protection policies were enacted in mid-1994. Regulations implementing the Basic Law were signed by the President on the same day that the Basic Law was enacted in March 1, 1994.

Environmental Issues

CONAMA had the legal mandate to define Chile's environmental policy, propose environmental legislation, and develop and maintain the resources necessary for administration and enforcement of environmental regulations. CONAMA was represented in the 12 Chilean regions by the COREMA'. Each COREMA was presided over by a Regional Administrator (an appointed official approximately equivalent to a U.S. Governor) and was

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composed of regional-government, private sector, and nongovernmental organization representatives. The COREMA'S were charged with the implementation and enforcement of new regulations and, through its regional subsidiaries, authorized pollution prevention and abatement plans and advised the Ministry of Mining on designing environmental policies and the regulations implementing these policies, on diagnosing environmental impacts, and developing general environmental objectives and policy responses.

Regulations implementing the Basic Law on the environment established equal rights and responsibilities for public and private enterprises. The Government planned to phase in the legislation's provisions gradually to minimize disruptions to the economy and to allow time to develop monitoring and enforcement capabilities. The Government promulgated two decrees intended to reduce fixed-source air pollution (including Decree Law No.185 of 1991, wich regulated sulfur dioxide emissions) and was implementing regulations pertaining to the disposal of waste water from mine tailings in coastal zones. It also took some initial steps to contain and eventually reduce the difficult problem of Santiago's severe air pollution.

Decree Law No.185 divided Chile into two zones, the mining district (Zone 1, which covers more than one-half of the country, from Rancagua, site of the El Teniente smelter, to the border with Peru) and the agricultural-industrial part of the country (Zone 2, from the area south of Rancagua to Tierra del Fuego). The decree stipulated that Zone 1 must meet emission standards published by the U.S. Environmental Protection Agency and that Zone 2 must meet the considerably higher air quality standards in force in Scandinavia.

Under pressure from the Atacama Environmental Health Service and the Chilean Federal Government, Empresa Nacional de Mineria (ENAMI) will install a sulfur-recovery plant to control sulfur dioxide emissions at its Hernan Videla Lira (Paipote) smelter. During 1995, CONAMA was to determine if ENAMI' Paipote smelter had met its emissions reduction obligations. ENAMI will continue a $8.6 million contract with a Santiago-based construction company to install an additional sulfuric acid plant at Paipote. The acid plant will be moved to Paipote from the old Chagres smelter, which was replaced by a new Flash Furnace Smelter by Exxon's Cía. Minera Disputada de-Las Condes S.A. in the Catemu Valley 90 kilometers (km) north of Santiago.

At Corporación Nacional del Cobre de Chile (CODELCO's) El Teniente Division, the commitment to maintaining productivity while exercising environmental responsibility has become a top priority over the past several years. Two specific objectives were identified at El Teniente, (1) reducing emissions and monitoring the living conditions of employees and local inhabitants and (2) utilizing the vast amount of waste water from mine tailings. El Teniente has announced a 3-stage plan which will involve the construction of three sulfuric acid plants, the installation of four additional environmental monitoring stations, a community action plan involving the study of the environmental impact of pollutants on mining workers and their families, and an upgrade of the environmental control measures currently in existence. This project will focus on the Caletones smelter and the neighboring towns of Caletones and Coya. The total cost of these measures would be around $300 million. CODELCO has already announced early in 1995 that the contract for the construction of this first plant has been awarded to Mitsubishi of Japan. The cost of this construction alone will be $50 million.

When completed, the plant will have the ability to neutralize 36% of the sulfur and 49% of the arsenic currently found in the gas emission from the Caletones smelter. The second and the third acid plants will see that the Caletones smelter comply completely with the environmental measures demanded by the Supreme Decree No. 185. In total, anhydrous sulfur emissions will be reduced by 97%, arsenic by 98%, and 99% of all particulate material matter released by the smelter will be captured.

El Teniente had also placed a high priority on the disposal or storage of water used in the mining process. To this end, surplus water has been stored in several reservoirs at Arena, Agua Amarga, Barahona, Cauquenes, and Colihues. The most recent reservoir built for this purpose by CODELCO was at Caren Reservoir. The reservoir is fed by a number of drainage channels that take the water from the mine to the tailings dam.

Minera Escondida's operations west of Antofagasta was subject to high environmental management standards. Prior to its production startup, Escondida carried out ecological base line studies in its operation areas. In the case of the Coloso port, Escondida prepared an environmental impact study, and it designed a wide monitoring and environmental control program of its activities. The study was analyzed and approved by the COREMA of Region II, where the mine is located.

Production

COCHILCO reported that Chilean copper production increased 12.1% to 2.49 million metric tons per year (Mt/yr) compared with that of 1994, of which 1.32 Mt/yr was contributed by the private sector (53%) and the remainder (47%) by CODELCO. The National Mining and Geology Service, an agency under the Ministry of Mines, reported that gold production in 1995 increased 10.1% to 42,700 kilograms (kg) (another record high for Chile), and silver production increased 5.0% to 1,032,000 kg in 1995. The medium- and small-size mines produced 92.7% of the gold and 71.6% of the silver in the country, followed by

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the large-size mines of CODELCO, with 7.3% of the gold and 28.4% of the silver produced primarily as byproducts of their copper operation.

CODELCO accounted for all of the output of molybdenum in the form of molybdenum trioxide and concentrate. In addition, CODELCO was a major sulfuric acid producer.

The increase in production of copper by the private sector in 1994 and 1995 established a new benchmark in Chile's historical copper output chiefly because of the startup operation of five new copper mine projects, La Candelaria, Cerro Colorado, Quebrada Blanca, Ivan-Zar, and Zaldivar and the increase in output of the expanded La Escondida and El Indio mines and the second phase of the copper cathodes production of the Minera Michilla project.

Beginning in 1994 with addition of several new copper and gold mining projects, the output of copper cathodes had increased from 7% to about 14% in 1995 making Chilean mining highly competitive in the world economy.

Trade

According to Central Bank of Chile, mining products led the Chilean exporting sector in 1995 and totaled a record of $7.9 billion in shipments overseas. Chile's total exports for 1995 were $16.04 billion, an increase of 38% compared with that of the previous year. The Central Bank announced that total value of exports in 1995 actually double those of 1990, when they were $8.37 billion. The Bank added that mining despatches represented 49.4% of Chile's total exports and rose 51% compared with that of 1994. Chile's main export was worth $6.7 billion, or about 41.8% of the total exports. This was due mainly to the relatively high average price of $1.33 per pound maintained throughout the year. Besides copper, Chile's main minerals exports were ferromolybdenum, gold, iodine, iron ore, iron pellets, silver, sodium nitrate, lithium carbonate, molybdenum oxide, nitrate, potash, and zinc. CODELCO shipped 1.06 (Mt) of fine copper in 1995, 6.3% higher than in 1994, of which electrolytic copper (copper cathodes) was 74.5%; blister, 4.3%; concentrates, 11.2%; and other, 10%.

Revenues from copper sales by CODELCO in 1995 were about $3.6 billion, $1 billion more than those in 1994. Revenues from byproduct sales during 1995 were $353 million, $183 million more than those in 1994. The most significant byproduct was molybdenum, sales of which amounted to $25.6 million for shipments of 2,590 metric tons (t), fine content. Doré metal, silver, selenium, molybdenum oxide and other were valued at $316 million. According to COCHILCO, copper exports totaled $6.3 billion, 41.4% higher than those in 1994. During 1995, foreign investment in Chile totaled $3.1 billion, of which $1.8 billion was in mining. Mining continued as the most attractive sector for foreign investment, contributing approximately 58% of the total achieved foreign investment in 1995. The positive impact of the startup of new copper projects also affected mineral exports. An increase of 41.6% was registered in copper exports in 1995; it was due mainly to the startup operation of new copper and gold projects and to the increase in the price of copper.

Structure of the Mineral Industry

The Chilean Government through the Ministry of Mines exercised dominant control over the mineral industry through three large state-owned mining companies and four regulatory agencies. The mining companies were CODELCO, ENAMI, and Corporacion de Fomento de la Production (CORFO). CORFO included Cía. de Acero del Pacífico, S.A. de Inversiones (CAP); Empresa Nacional del Petróleo, S.A., (ENAP); Empresa Nacional del Carbón S.A. Cía. Chilena de Electricidad, S.A.; and Sociedad Química y Minera de Chile S.A. (SQM). The four regulatory agencies were SERNAGEOMIN, COCHILCO, the Foreign Investment Committee, and CONAMA.

CODELCO, the largest copper producer and exporter in the world, was composed of four divisions: Chuquicamata; El Teniente; Andina; and El Salvador, which produced 47% of all Chilean copper production in 1995. CODELCO was also a producer of gold, metal doré, molybdenum (trioxide, concentrate), and silver, as well as sulfuric acid and ammonium perrhenate (rhenium).

ENAMI, the second largest state-owned company, was created in the early 1960's to promote mining activities, to process and market copper and other minerals, and to provide services to the mining industry. To strengthen this position, ENAMI established as part of its mission the promotion, development, and processing of Chile's small- and medium-size nonferrous metals mines output. ENAMI also purchased concentrates of copper, gold, and silver; precipitate and minerals for direct smelting; and anodes and blister for its smelters and refineries. ENAMI served as a market regulating force by determining rates for minerals and mining products bought from producers in potentially attractive mining zones, provided credit to miners who lacked access to standard sources of financing, facilitated miners' access to banking sources, and provided training and support programs to small-size miners. Furthermore, ENAMI produced, sold, and distributed sulfuric acid; participated with private investors in the development of small- and medium-size mining projects; guarded against potential environmental harm from mining production; and bought ores for flotation and leaching at its own plants.

The total labor force, including staff and office personnel working directly in the minerals sector, numbered 92,900, representing about 1.9% of the total labor force of nearly 5 million in the country. The metals sector's labor force was 61,000, about 66% of the mineral sector labor force

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total, of which 47,000 were copper workers. The industrial minerals sector labor force was 3,400; and the mineral fuels sector was 13,000, of which 85% were coal miners. CODELCO employed about 39,000 people, including its own copper workers and contractors' personnel in 1995, or about 64% of the total metals sector employees.

Commodity Review

Metals

Copper.—Chile's increased copper production in 1995 reinforced its position as the world's largest producer and exporter of copper. According to official statistics released by the Ministry of Mines through its agencies COCHILCO and SERNAGEOMIN, Chile produced another record high of 2.49 Mt of copper in 1995. The increase in copper production of 12.1% from that of the previous year was due to the additional output from the new private sector's La Candelaria, Cerro Colorado, Ivan-Zar, Quebrada Blanca, Zaldivar, and La Escondida mines. CODELCO's copper production decreased by only 1.9% in 1995 compared with that of 1994 owing to the decline in the average grade of copper from 1.15% in 1994 to 1.10% in 1995, except for the Andina Division where the copper ore grade had increased from 1.28% in 1994 to 1.37% in 1995, and the higher volume of ore treated in the Chuquicamata and El Salvador Divisions. CODELCO's investments in 1995 were $349.4 million, 6.6% less than those in 1994, and were chiefly directed toward developing the corporation's new projects productive capacity and resolving its environmental problems. During the first half of the year, CODELCO contributed $772 million to the national treasury, an increase of about 80% compared with the same period of 1994.

Among other CODELCO investments were the startup of operation at Radomiro Tomic Mine; the continuation of the Andina expansion project, the geological exploration in association with private companies of the Mamina, Puren, Agua de la Falda, Cerro Coya, Picacho, and El Cabrito Copper Projects; and the selection of a strategic partner in the Tocopilla thermal powerplant project.

Under study by ENAMI were the following two projects, one of which was the feasibility study for the modernization of Las Ventanas and Paipote smelters. ENAMI was developing an environmental protection plan including installation of a modified El Teniente-type converter and a new electric furnace at Las Ventanas smelter; startup of a sulfuric acid plant in Las Ventanas, permitting a 30% reduction in gaseous emissions and a 60% in particulates; and investment of a $14 million in an oxygen plant to produce 300 t/yr of SO_2 delivered to the smelter for concentrate treatment.

Production at Minera Escondida's solvent extraction-electrowin (SX-EW) cathode plant at Coloso, 14 km south of Antofagasta, should be at capacity levels of 6,700 metric tons per month by yearend 1995. Unexpected problems have kept the plant considerably below capacity since its startup in January 1995, but most of these were reported to have been solved. Escondida uses ammonia leaching for concentrates followed by electrowinning to produce copper cathodes. Production reached 466,913 t/yr in 1995 of fine copper, 20,000 t lower than projected. Escondida embarked on phase 3 of its mine expansion, which will see production rise to 800,000 t/yr of fine copper in 1996.

The Chilean copper producer Refimet is now moving ahead with the expansion of its copper smelter near Antofagasta. The expansion, which includes oxygen enrichment, anode casting facilities, and a second sulfuric acid plant, will see capacity rise from 90,000 t at present to some 150,000-160,000 t/yr by 1997. Total investment in the expansion, not including the oxygen enrichment plant, is just under $50 million. Refimet currently produces blister copper, but the move to produce anode is aimed at securing greater added value and access to a long-term sales contracts. Refimet has already secured a long-term contract, starting in January 1997, to supply CODELCO's Chuquicamata refinery with an undisclosed tonnage, with the balance likely to be exported. Refimet is also hoping to boost sulfur dioxide capture to around 85% with the installation of this second acid plant, as well as cut unit production costs. To feed the expanded smelter, the company recently secured a 10-year concentrates supply contract with Minera Escondida. Refimet had been taking concentrates, at a rate of around 60,000 t/yr, from Escondida since its inception in August 1993, but the tonnage has been increased to 160,000 t/yr and extended to 10 years from 1996. At current prices, the contract is worth around $200 million per year and will account for 67,000 t/yr of the smelter's output. Refimet is now owned by the Canadian companies Barrick (25.1%) and Noranda (24.8%) and by original share holders of a consortium of local Chilean investors and management (50.1%).

EXXON's Cia. Minera Disputada de-Las Condes S.A. in 1995 lifted the production stoppage which it had imposed on its blister contracts in mid-April 1995 after technical problems at its Chagres smelter. Officials at Chagres are continuing to monitor the progress of repairs to the smelter's new flash furnace which shut down in April because of technical problems. The smelter is monitoring the modifications made to resolve the problems which arose in the first stage of the startup of new technology. Empresa Minera Mantos Blancos, S.A.'s new Manto Verde SX-EW project, 85 km southeast of the port of Chanaral, was based on seawater leaching of 5.4 Mt of 0.9% copper oxide ore from an open pit mine and would produce 53,500 t/yr of copper cathodes.

The Anglo-American Corporation, which controlled Minorco and Mantos Blancos, acquired a one-third interest

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in the Collahuasi copper project in northern Chile from Chevron Corp. of San Francisco, California, for $190 million. The two-Anglo American companies formed a new entity, Minera/Mantos Minorco, to complete the acquisition. The other two partners in the project are Falconbridge Ltd. of Toronto, Canada, and the Shell Group of the Netherlands. The property consisted of two deposits, Ujina and Rosario. The Ujina deposit, totaling more than 100 Mt and grading an average 2% copper, would be processed through a heap-leaching and SX-EW plant with startup slated for 1997. Mantos Blancos sold its copper deposit, Lomas Bayas, in Sierra Gorda (Region II), to Gibraltar Mines, a Canadian mining company, for $19 million in November.

The Santa Barbara and Manto Verde SX-EW copper operations in Chile, owned by Minorco subsidiary Mantos Blancos, are now operating following the go-ahead by the company late in 1995. Santa Barbara is an expansion of an opencast mine operated by Mantos Blancos north of Antofagasta. The investment, which included the installation of a new primary crusher, conveyor system and a 30,000-t/yr cathode SX-EW circuit, totaled $68.2 million. The company has also extended the mine's life to year 2010. Production should continue at current levels of around 77,400 t/yr of which 46,000 t/yr will be in the form of copper in concentrates until the middle of the next decade. The new SX-EW circuit produced 2,633 t of copper cathode in December, its first full month of operation. The old smelter at Mantos Blancos is being dismantled. At Manto Verde, the new SX-EW plant has so far produced some 570 t of cathode with output in the first year of operation projected at 30,000 t. Manto Verde is an opencast, heap-leach operation near El Chanaral in the Atacama region. The project has cost some $180 million and is schedule to produce 15,000 metric tons per day (t/d) of ore and 38,400t/yr of cathode over a period of 16 years.

La Candelaria, owned 80% by Phelps Dodge and 20% by Sumitomo, Corp., of Tokyo, Japan, began its operation in August 1994. The plant was scheduled to process some 28,000 t/d of ore, producing 125,000 t of copper in concentrate (30% copper content) and more than 2,532 kg of gold per year. La Candelaria partners have invested $560 million in opening the mine and constructing the plant and new port facilities at Caldera. Expansion plans were under consideration, and a decision to possibly double production would be made in 1995. Candelaria had an investment approval from the Government of Chile for $1.5 billion, the third largest ever, after seeking funds from Far Eastern and European sources. Sumitomo, the world's largest copper trader, agreed to take a 20% ownership stake in La Candelaria for $40 million and support its share of debt financing. The Overseas Private Investment Corp. (OPIC), a U.S. Government insurance agency, awarded a $50-million loan to La Candelaria. In addition, La Candelaria was expected to obtain risk insurance coverage for $100 million from OPIC. La Candelaria is near Copiapo on the southern edge of the Atacama Desert. The mine began production in July 1994. It has estimated reserves of 366 Mt with an average grade of 1.29% copper and 0.26 gram per metric ton (g/t) of gold and 4.5 g/t of silver. The mine had an expected lifespan of 34 years, and, when completed, would represent the biggest new copper investment since Broken Hill Proprietary Company Limited (BHP), BHP-Utah's La Escondida Mine was inaugurated in early 1991.

Other copper projects included Quebrada Blanca in northern Chile in Region I,[3] about 170 km southeast of Iquique and at 4,300 meters (m) above sea level. The deposit was owned by Compania Minera Quebrada Blanca S.A., a joint venture of Cominco Ltd. of Canada (38.25%); Teck Resources International, Ltd. (29.25%); Cominco International, Ltd. (9.0%); ENAMI (10%); and Sociedad Minera Pudahuel Ltd. (13.5%). Quebrada Blanca reserves were estimated at 90 Mt of copper with an average grade of 1.3% in its secondary enrichment zone, enough to keep the mine in operation for 14 years. An additional 400 Mt of copper sulfide ore with a average grade of 0.5% also was reported, The mineral was being processed by heap leaching using the bacterial leaching techniques. The project started production in September 1995 and was expected to produce approximately 75,000 t/yr of fine copper.

Compañía Minera Cerro Colorado, S.A., the Chilean subsidiary of Río Algom Ltd., of Vancouver, Canada, completed a partial financial package of $150 million for the copper project east of Iquique, high on the northern plateau. As a result of new drilling, Rio Algom reported an increase in ore reserves at Cerro Colorado to 193 Mt of ore grading 1.08% copper from 79 Mt grading 1.39% copper. According to officials, the additional reserves will enable the mine to produce for much more than 20 years (at an expanded mining rate) and to provide the company with the potential for further production expansions in the future. The project was expected to produce 45,000 t of copper cathodes in 1995. The open pit mine used bacteria heap leaching and the SX-EW process. The initial startup investment was $290 million.

Falconbridge Ltd. and Minorco Plc., announced a deal in late December to sell 12% of the huge Collahuasi copper project in Chile's Region I to a consortium of Japanese smelters in return for a long-term smelting contract. Mitsui & Co., Nippon Mining & Metals Co. and Mitsui Mining & Smelting Co., have agreed to take a 12% equity stake in Collahuasi in return for a long-term contract to buy 250,000 t/yr of copper concentrate.

Mitsui & Co. also agreed to provide $200 million in customer financing, while the consortium also shares project expenses and pays a $6.8-million premium on the smelting contract. Falconbridge and Minorco will see their equal 50% stakes in Collahuasi drop to 44% each after the

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deal closes, expected by mid 1995. The deal paved the way for project financing for Collahuasi which will cost about $1.75 billion to put into production at a rate of 330,000 t/yr of copper concentrate and 50,000 t/yr of copper cathodes by 1999. The purchase price was based on Shell's sale of its one-third stake in Collahuasi to Falconbridge and Minorco in May 1995. In September 1993, Collahuasi decided to focus its exploration in and around the Rosario, Ujina, and Huinquintipa areas. Reserves at Rosario, its main deposit, were estimated to contain at least 800 Mt of primary ore with an average grade of 0.8% copper and 25 Mt of secondary ore grading 1.7% copper. The Ujina reserves surpassed 500 Mt with about the same grade ore as Rosario.

Rayrock Yellow Knife Resources Inc. of Toronto, Canada, began production at the Ivan-Zar Mine, 40 km northeast of Antofagasta. The SX-EW project is operating at about 50% capacity and is expected to reach its annual production rate of 8,000 t/yr of copper cathodes by yearend 1995. The project consisted of 85 square kilometers. of mining claims containing two deposits (the Ivan-Zar and Emperatriz) and 97 square kilometers of exploration claims. Copper is produced by using a combination of openpit and underground mining methods and bacteria-assisted sulfuric acid technology to leach the metal from oxide and sulfide ores. The solution is combined at the electrowinning process to produce a cathode of high purity. The total minable reserves at the two deposits amounted to 4.6 Mt of ore averaging 2.5% copper, indicating a minable reserve life of 10 years.

The Zaldivar copper mine and leach operation successfully started operations in 1995. The project, which shipped its first electrowon cathode in June, should see total production of 23,000 t in 1995 and 85,000 t in 1996, rising to full capacity of 125,000 t/yr by 1997. The mine was owned by Cia. Minera Zaldivar S.A., a 50-50 subsidiary of Placer Dome Inc. of Canada and Outokumpu Copper Resources Chile B.V., and is 175 km east of Antofagasta in the north of Chile and at about 3,000 m above sea level. The openpit mine has reserves of 425 Mt of ore grading 0.78% copper, which is sufficient for 19 years of production at the planned rates. Over its lifetime, Zaldivar is expected to produce 1.9 Mt of copper cathode.

Gold and Silver.—Among the gold-producing companies in Chile, the El Indio Mine remained the largest. It was owned by Barrick Gold Corp. of Canada, which acquired the properties from Lac Minerals Ltd. also of Canada in 1994. In 1994, Barrick Gold Corp. planned to spend about $500 million to expand its rich El Indio and and other gold properties in Chile and was expected to spend about $200 million in 1995 on the El Indio and the El Tambo Mines and to finalize the feasibility study of its Nevada gold project in Chile. According to latest studies, Barrick's El Indio gold deposit holds reserves greater than originally estimated and will allow the company to increase its expected production from 31.1 t/yr to about 46.7 t/yr and to 62.2 t/yr. The total reserves of gold of the El Indio deposits was estimated to be about 273.7 metric tons.

The second largest gold producer in the private sector in Chile was La Coipa Mino, owned by Dayton Development Corp., Placer Dome, and TVX Gold Inc. of Canada.

The largest producer of silver in Chile was the La Coipa Mine with silver as a byproduct of gold production. La Coipa's silver output was about 430,000 kg in 1993, 43.7% of the country's total output. La Coipa, operated by Cia. Minera Mantos de Oro Limitada., was operating at its full capacity of 15,000 t/d of ore by yearend 1994. Followed by CODELCO, other important producers of byproduct silver were El Indio, La Escondida, and El Bronce de Petorca. Niugini heap-leach operations contributed 1,700 kg of gold in doré bars. CODELCO maintained its level of output of gold at about 2,200 kg in 1994 as a byproduct of its electrolytic copper refining. Other precious metal producers included Choquelimpie (Vilacollo); El Hueso (Homestake); San Cristóbal (Niugini); La Escondida, El Bronce de Petorca, and El Guanaco project owned by AMAX Gold Inc.

SCM Vilacollo Ltd., the company formed by Shell, Citibank, and Northgate to operate the Coquelimpie Mine near the Bolivian border, was seeking new reserves near the mine. SCM Vilacollo Ltd. and Cia Minera Mantos de Oro Ltd. were reviewing financing plans to raise the required $135 million capital investment. According to the feasibility study completed by Mineral Resources Development Inc., ore extraction at El Refugio would require an open pit with a stripping ratio of 1:1. The study recommended a plant with a processing rate of 33,000 t/d. At that rate, Bema Gold Company would produce 7.2 t/yr of gold for 13 years.

Iron Ore, Manganese, and Steel.—In 1995, Chilean iron production and exports decreased 2.0% to 8.2 Mt and 5.6% to 6.6 Mt, respectively. In 1995, pellet production was 3.0 Mt, similar to the year before. The Algarrobo Mine output, which feeds the pellet plant, would be depleted by the end of this decade. Cia Minera del Pacifico S.A. (CMP) the owner, has entered into joint venture with the company MC Inversiones Limitada. a subsidiary of Mitsubishi Corp., to expand the iron deposit Los Colorados, a property of CMP in the Province of Huasco in Region III. This joint venture, Compania Minera Huasco S.A., is a closed corporation with a straight 50-50 ownership. To finance the project, the company signed a loan contract with MV Cayman Ltd. for the sum of $71.7 million. The total investment of the project is estimated at $107 million. The reserves of Los Colorados are calculated to be roughly 245 Mt of iron ore grading 45%. The expansion of the deposit will enable CMP to process the preconcentrate into pellets in its plant in Huasco, thereby producing 4 Mt of pellets per year by 1998. CAP is currently producing around 1 Mt/yr of iron concentrate

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from the deposit, and the project aimed at increasing output by mid-1998. Mitsubishi was to supply all the investment required for the expansion program, while CAP would contribute the mining rights and other assets to the equally held joint venture. Manganesos Atacama, S.A., a subsidiary of CAP, a Swiss-Chilean industrial group, owned iron mines and Chile's largest steel plant, producing ferromanganese and ferrosilicon alloys and manganese as well as steel cones for mills for the domestic market in a plant in Coquimbo. The company produced manganese ore at the El Corral Quemado and Los Loros Mine in Region IV; MASA also bought ore from other producers in the same region.

Most of the manganese produced by MASA was bought by the Huachipato smelter. The production of steel ingots at Huachipato amounted to 1.0 Mt in 1995, the same as in 1994. CAP reported that in order to increase the production capacity at its Huachipato smelter and to reduce operating costs, the holding company was considering an investment of $350 million to modernize the plant between 1995-98.

Lead and Zinc.—Lac Minerals-owned Sociedad Contractual Minera el Toqui continued production despite problems resulting from low zinc prices. El Toqui, Chile's largest zinc miner, produced some 63,000 t of concentrate in 1994 containing 31,000 mt of zinc. A temporary shutdown of El Toqui's zinc operations would cost the company some $5 million; so, Lac opted for continued production while at the same time reducing costs at the 1,500 t/d concentrator at Coyhaique in the far south of Chile. Production of zinc increased 5.2% in 1995 to 30,968 t, of which 91% was from SCMT. Lac completed an expansion program in 1993, which was largely responsible for the notable increase in Chilean zinc production for the past 3 years. However, low zinc prices have induced Lac to postpone its plans to expand its El Toqui zinc mine near Coyhaique.

Industrial Minerals

Lithium and Potassium.—Chile was the second largest producer of lithium in the world after the United States. Production of lithium carbonate in 1995 was estimated to be 14,000 t, 34% more than that of the previous year. (SQM), the private nitrate and iodine producer, announced investment plans totaling $230 million for the next 4 years. This investment followed $60 million in 1994, focusing primarily on the Minsal project on the edge of the Atacama salar and a new potassium nitrate plant at Coya Sur, just south of Maria Elena in Region II and inaugurated in October. The new plant added a productive capacity of 100,000 t of potassium nitrate to SQM's previous 260,000 t. The plant, which cost $13 million to construct, would produce technical-grade products for industrial and agricultural use. The first phase of the Minsal project would require a $75 million investment and have a production capacity of 300,000 t of potassium chloride. At present, SQM spends some $35 million on imported potassium chloride for use in potassium nitrate production. SQM, acquired full control of the Minsal project at yearend 1995 from the state holding company CORFO. The transaction was about $7 million. Before the deal, SQM owned 81.2%. SQM will now have the right to name the fifth director of Minsal. Cocar S.A. sold all of its shares of the subsidiary, the Chilean salt company Cosal S.A., to SQM for an undisclosed amount. The shares represent 55% of the parent company.

Nitrates and Iodine.—Cia Minera Yolanda S.A., a Chilean subsidiary of KAP Resources Ltd. of Canada in the Taltal zone of Region II, was planning to produce roughly 300,000 t/yr of sodium nitrate, 357,000 t/yr of potassium nitrate, and 180 t/yr of iodine using heap-leaching methods by utilizing seawater and solution concentration by solar evaporation in ponds before crystallization. The company planned that part or all of the sodium nitrate produced would be converted to potassium nitrate, utilizing an additional potassium chloride treatment and recrystalization, and iodine would be extracted from the residual waters. A feasibility study was first completed for the Yolanda iodine-nitrate property in Chile's Atacama Desert in 1990 and then updated a few years later. Now held by a wholly owned subsidiary of KAP Resources Ltd., in 1995, the project has advanced to the point where a financing package for the mine development is being arranged. KAP has received commitments in 1995 for the $41-millon debt package from a consortium of four banks and the Inter-American Investment Corp. To raise the remainder of the required equity, KAP has entered into an engagement letter with First Marathon Securities. The investment firm will endeavor to raise about $25 to $30 million of common equity and equity equivalent. Assuming the financing is arranged, KAP will release its fixed price contract for the start of construction activity during July 1995. Production would begin about 18 months later. At last report, the project hosted reserves of over 120 Mt of ore containing an estimated recoverable resource of 40,500 t of iodine and sodium nitrate adequate to produce 13.3 t of potassium nitrate.

With the aim of doubling its production of iodine, SQM started development of a $23-million expansion program in Regions I and II. The first stage of the plan has been completed and plans the startup of the expansion at the Florencia nitrate plant 100 km north of Antofagasta, which is expected to produce 1,000 t of iodine in 1996. The program, which was being carried out by the subsidiary of Sociedad Química y Minera de Chile S.A. (SOQUIMICH), SQM Yodo, also plans the construction of two additional plants at Pinto in Region II and another in Region I. Soquimich reports that the expansion is to allow the company to offer iodine manufactured under the strictest

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pharmaceutical industry standards of the United States and Europe, utilizing two patents that it obtained in Chile for the product's commercialization. The company reports that because of the plan, it expects to produce some 8,000 t of iodine in 1997, about half of the world demand for the product.

Sulfur.—Chile has been an importer and producer of sulfur for many years. In 1995, Chile imported about 42,000 t of sulfur, 27.5% more than that of the previous year, mostly from Bolivia, Canada, and the United States, valued at $2.5 million. Chile's native sulfur production derived from caliche decreased almost 96% to 937 t. Chile's total production of sulfur, including sulfur derived from smelters and oil refineries, as well as imported, was used as raw material to produce sulfuric acid in various industrial plants spread from Regions I through VIII. About 94% of the acid was used in mining and metallurgy. The balance, around 10,000 t, was applied mainly as a fungicide. Condesa Mining Corp. of the United States received authorization from the Foreign Investment Committee to carry out at $25-million development in two sulfur mines near San Pedro de Atacama with a capacity to treat 1,000 t/yr. The project would include construction of a concentrating plant, a refining plant, and a pipeline to the Port of Coloso, south of Antofagasta. No startup date had been reported.

Chuquicamata, as part of a $323-million investment to reduce SO_2 emissions by a third, added a new 620,000 t/yr acid plant (No.4) to replace the 180,000 t/yr old No.1 plant, for a total production of 1.3 Mt. Meanwhile, Refinadora Metalurgica (Refimet) would produce 90,000 t/yr of acid in its new copper smelter. Refimet and Minera Escondida signed a contract to smelt 160,000 t/yr of Escondida's copper concentrate. This agreement increases significantly the volume of copper concentrate from Escondida that would be processed in local smelters. It will also facilitate the expansion of Refimet's installations, which will include the construction of a second sulfuric acid plant and other measures to reduce environmental contamination by eliminating emissions of sulfuric gases. The contract has a duration of 10 years beginning in 1996; and, at current price levels, represents an annual transaction of a approximately $200 million. Consumption of sulfuric acid in Chile amounted to 900,000 t/yr. Startup of new sulfuric acid plants using gases from the smelters would increase CODELCO's production of more than 1.8 Mt/yr. As a result, Chile would significantly lower sulfur imports. Sulfuric acid also was produced from gases from four copper smelters: Chuquicamata, Las Ventanas, Paipote (Hernan Videla Lira), and Chagres. These plants have a production capacity of 2.0 Mt/yr, of which 1.3 Mt/yr was from Chuquicamata; 290,000 t/yr from Las Ventanas; 60,000 t/yr from Paipote; and 330 t/yr from Exxon's Chagres smelter to replace its old 70,000 t/yr facility. Also, about 20 smaller sulfuric acid plants between Arica and Rancagua were using sulfur as raw material. The capacity of these plants totaled approximately 500,000 t/yr.

Mineral Fuels

Coal.— Bituminous coal output in 1995 was estimated at 1.5 Mt. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence on petroleum. Chile, with a population of more than 13.7 million, has a small coal market in which the most important consumers were electric utilities. Demand for electricity was concentrated in the central part of the country, where 93% of the population lived, and in the northern area associated with mining and minerals refineries. The largest coal producer in Chile was Cia. de Carbones de Chile S.A. (COCAR), which strip-mined subbituminous coal in Pecket, near Punta Arenas. It was reported that COCAR was still considering a number of plans for future coal output. Its current production from the Pecket Mine was 1.2 Mt/yr. COCAR has a long-term contract with CODELCO (expiring in 1997 but expected to be renewed sooner) to supply CODELCO's Tocopilla powerplant with 850,000 t/yr. However, Tocopilla was taking all Pecket's output. Additional potential power stations projects for later this decade included 150-megawatt (MW) plants at Huasco and Tocopilla and a 400-MW facility in the north of the country. By the end of the 1990's, these could increase total coal demand to 4.5 Mt/yr. COCAR was examining a number of options. Pecket could be expanded by moving into an underground operation, and it has been reported that prefeasibility studies have examined the development of a further 100 Mt of reserves at Pecket for an output of 1 Mt/yr. The second possibility was to develop the Isla Riesgo deposit, which would be an open pit, some 40 km from Pecket Mine.

The large number of direct electrowinning copper projects in the north of Chile will require new powerplants, which should come on-stream in the next 3 to 5 years. They include power unit 16 in Tocopilla to supply Chuquicamata's plant expansion; a grassroots unit in the iron ore Port of Huasco, funded by Chilean Electricity Generator (CHILGENER), CAP, and COCAR, operated as a joint venture named Guacolda, to supply Phelps Dodge's Candelaria expansion and all the new precious metal mines in the Atacama District; and a third unit that probably would be built in Mejillones, north of Antofagasta, essentially to supply Escondida's expanding needs.

COCAR, at its Pecket strip mine, would have to double its capacity to supply the additional demand for an output of 1 Mt/yr. Bituminous coal was found in underground deposits in Region VIII. Operations were carried out in this area by the state-owned Empresa Nacional de Carbon S.A. (ENACAR) that produced around 500,000 t/yr, with

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Carbonifera Schwager contributing 340,000 t/yr.

The shareholders of ENACAR approved an increase in the company's capital of $62.5 million, which will be financed with emission of more than 3.8 billion shares. ENACAR's official in 1995 stated that the increase will finance expansion and improvement of operations and that the new infusion of capital will finance the company's debt. ENACAR receives financing not only through stocks but also directly from the Government. However, the continued capital flow from the state is conditional. The company needs to prove the existence of 2.5 Mt of coal by the end of 1996, or that financing will be cut off in 1998.

Natural Gas.—The principal natural gas reserves of the country were found in the Magallanes Basin in the far south of Chile. Natural gas production increased slightly to 4,300 million cubic meters, continuing the declining trend since 1990. Of the total production, about 51% was reinjected; and 49% was marketed internally. The natural gas that was reinjected by Empresa Nacional del Petroleo (ENAP) in the straits of Magellan Region in the past were to be used to produce 150,000 t/yr of ammonia and 570,000 t/yr of urea at Cabo Negro. During 1995, 55% of the natural gas was produced from offshore, 23% from onshore, and 22% from Tierra del Fuego.

Official of the National Energy Commission (CNE) said that next year efforts would be directed at the approval of the geothermal energy law and the passage of the bill to modify the Gas Law, establishing regulations for the pipeline transportation of liquid hydrocarbons. CNE had carried out studies of the gas pipeline projects' progress, outlining that the Gas Andes project was the most advanced and was expected to be operational in May 1997. Both the Gas Andes and the Trans Gas (Gaseoducto Transandino/Gas de Chile) consortium are planning to import natural gas from the Neuquen area of Argentina, the Gas Andes across the Andes near Santiago, and the Trans Gas near Conception. The CNE official indicated that the Gas Andes consortium plnned to invest a total of $284 million in this gas pipeline project, of which $110 million will be invested in Chile. CNE reported that the Trans Gas consortium is at the stage where its gas transport concession has been granted. However, Trans Gas has not yet presented its environmental impact study. The investment by the Trans Gas consortium is estimated to be $689 million, of which $484 million is to be in Chile. The Gas Sur pipeline project proposal is currently at its "open season" stage.

Petroleum.—Chilean production of crude oil sustained a further decrease of 15% in 1995 to 3.8 million barrels (Mbbl). Imports of crude oil in 1995 were 47.7 Mbbl compared with 43.3 Mbbl in 1994. The new 105,000-barrels-per-day (bbl/d), 450-km oil pipeline from the southwestern Argentina Province of Neuquén to the Chilean Port of San Vicente on the Pacific Ocean which was expected to be opened in early 1995, has been delayed momentarily for environmental reasons. The most important private infrastructure project so far in the Southern Cone region of South America, the pipeline would provide Chile with more than two-thirds of its import needs. The pipeline also set the stage for much wider energy integration in the Southern Cone. A $220-million pipeline was built by Oleoducto Trasandino S.A., a company formed by Chile's state oil company ENAP and Argentina's Yacimientos Petroliferos Fiscales (YPF) and Banco Rio de La Plata (Argentina). Banco Rio de La Plata provided all the credit for the project in the form of medium-term loans that will be refinanced as long-term credits with other banks. YPF held 57.75% of the shares; Banco Rio de La Plata, 30%; and the balance by ENAP. Scheduled to be completed in early 1996, the pipeline would transport crude oil from Argentina's Puesto Hernandez oilfields to Chile's terminal in Talcahuano. Plans called for about 94,000 bbl/d of petroleum to be pumped into Petrox's terminal. Petrox was expected to process 37,700 bbl/d, and the remainder was to be shipped from the Port of San Vicente to Chile's Concon refinery.

ENAP reported $110-million profit in 1995 as a result of a 25% increase in output to 1 Mm^3 of crude from the Strait of Magellan. The Petrox and ENAP refineries contributed $65 million and $27 million, respectively, to ENAP's total profit.

In 1995, ENAP and Cardinal Resources of the United States have agreed to jointly explore for oil in a 5,000-square-km area near the country's border with Peru in the area named the "Arica Depression." The contract was for 35 years and involved a minimum investment of $500,000 during the contract's first 6 years, $4 million was expected to be spent in the oil search. Currently, Chile produces enough oil to satisfy 8% of its needs.

Reserves

In 1995, CODELCO produced 47% of the total copper in the country and held more than 9 billion t of copper reserves with an average ore grade content of about 0.9%, or the equivalent of more than 70 years of production at present levels representing about 20% of known global reserves. Its molybdenum production reached 17,884 t in 1995, making CODELCO the world's second most important producer. Confirmed copper reserves at the El Abra deposit are 669 Mt of copper oxide with an average ore content of 0.6% copper and 523 Mt of copper sulfide grading 0.6% copper.

Some of the private sector's reported copper reserves, listed as estimated figures and average grades were as follows: Escondida, 1,800 Mt, 1.6% copper; Cerro Colorado, 105 Mt, 1.3% copper; Quebrada Blanca, 85 Mt of 1.3% copper and 250 Mt of 0.5% copper; Zaldivar, 316 Mt of 0.9% copper and 680 Mt with 0.6% copper. The Collahuasi deposit had three areas with the following

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reserves and grades: Rosario, 800 Mt of 0.8% copper and 0.25 Mt of 1.7% copper; Ujina, more than 500 Mt of 0.8% copper and 200 Mt of 1.6% copper; and Huinquintipa, 7 Mt of 1.2% oxide copper. La Candelaria reported more than 360 Mt of ore reserves grading 1.09% copper and 0.25 g/t of gold; Andacollo, more than 25 Mt grading 1.3 g/t of gold and 250 Mt grading 0.6% copper; Manto Verde, 93 Mt grading 0.82% copper; and El Refugio, 112 Mt grading 1 g/t of gold containing about 90 t of gold. According to latest studies, the Canadian company Barrick's El Indio gold deposit holds reserves greater than originally estimated. The total reserves are reported to be at about 274 t of gold. The El Can Can deposit had proven reserves of 1.2 Mt of ore grading 8 g/t of gold and 60 g/t of silver. However, potential resources could reach 5.5 Mt of ore. It came on-stream in 1994 at a production of about 160 kilograms per month of gold.

The Colorado iron ore deposit contained some 245 Mt of minable ore, forming the basis for a 20-year project life and feeding Compania Acero del Pacifico's 4-Mt/yr pellet plant.

Infrastructure

Chile extends approximately 4,200 km along the Pacific Coast of South America and has an average width of approximately 180 km between the coastline and the Andes Mountains. Chile is divided into 13 regions, including the Metropolitan Region, which is not numbered like the other 12 regions, beginning with Region I at the northern border with Peru and continuing in sequence to Region XII at the southern end, with each region having a capital. Chile has three main geographical areas that vary dramatically in climate, resources, and population. The northern area (from Region I to Region IV) includes the Atacama Desert, one of the world's driest areas. Continuing south from Region V to Region X, is the central area, where 90% of the population resides. The Andes compose one-third to one-half of the middle of Chile. Near the northern end of the valley lies Santiago, Chile's capital and home to about one-third of the country's population. Industrial resources include large copper deposits, as well as coalfields and hydropower.

The southern area of Chile (from Region XI to Region XII) is one of the wettest and stormiest parts of the world. Less than 2% of the population resides in this area. Southern Chile's resources are concentrated in the area lying east of the mountains. These natural resources include coal, natural gas, and petroleum.

The railway system of Chile served all the important industrial, mining, and agricultural areas from Region I (Iquique) to Region X (Puerto Montt) for a total of 8,613 km. The pattern of Chile's highways was similar to that of its railways. The road system totaled 79,025 km, of which 9,913 km was paved, with most of the remainder of secondary quality.

International trade of mineral commodities, chiefly copper and its byproducts, was handled through the Ports of Arica, Antofagasta, Valparaiso, Tocopilla, Cruz Grande, Talcahuano, and San Antonio, which handled almost 60% of the total tonnage.

Crude oil, refined products, and natural gas were transported to consumption centers by three major pipelines that are 785 km, 755 km, and 320 km in length, respectively. In addition, a 450-km, 41-centimeter-diameter oil pipeline was expected to transport crude oil from Argentina's Puesto Hernandez oilfields to Chile's Talcahuano terminal in the near future, and a 1,200-km natural gas pipeline between gasfields in southern Argentina and Santiago was coming closer to reality as negotiations continued to show progress.

Outlook

Chile is attractive as an investment center, especially for export-related activities. The current prosperity of Chile is based on free market initiatives and a stable political system. A record $4.10 billion was posted during 1995 for achieved foreign investment, an increase of 0.1% from 1994, according to Chile's Minister of Economy and Executive Vice-President of the Foreign Investment Committee. Of the total of achieved foreign investment, $7.4 billion entered the country through its Foreign Investment Statute (D.L. 600), $407.1 million through chapter XIV of the Central Bank's International Exchange Norms, and $1.72 billion through issues of American Depository Receipts in 1995. The amount entering through Chile's D.L. 600 marked a 47.7% increase from the previous year's figures and was divided into $1.56 billion of direct capital investment, and $971.3 million in associated credits. The three primary destinations of achieved direct investment (D.L. 600) in 1995 were mining with $1.81 billion (58%); followed by industry, $320.7 million (12.7%); and services, $314.4 million (12.4%).

In 1995, officials of the United States, Canada, and Mexico were consulting closely with Chile to keep alive Chile's bid to join the North American Free-Trade Agreement (NAFTA) in the face of a trade policy impasse in the United States.

Chilean mining activities were concentrated in five mineral groups: coal, copper and its byproducts; industrial minerals; iron and steel; and precious metals. Chile's annual copper production was expected to grow from 2.49 Mt in 1995 to about 4.4 Mt by the year 2000, an increase of nearly 75%, representing more than 35% of world supply. Gold was projected to increase from about 39,180 kg in 1995 to 43,800 kg by 1996, representing an increase of nearly 12%; and silver was projected to increase from 1,032,000 kg in 1995 to about 1,040,000 kg during the

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same period.

The production of bentonite, boric acid, diatomite, iodine, lithium carbonate, nitrates, potassium chloride, potassium sulfate, and sulfuric acid were also expected to increase by significant amounts.

In the energy sector, coal production declined from 1.5 Mt in 1995 to 1.4 Mt in 1996. The Pecket coal mining project and the Isla Riesco project in the Otway inlet north of Punta Arenas are expected to save Chile about $40 million in energy costs and an additional $100 million in oil imports.

As highlighted earlier in this report, a total of more than $2 billion in new foreign investment is projected to be spent in Chile in the near future, firmly establishing its reputation as one of the most active mining countries in the world.

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[1]Text prepared Apr. 1996.

[2]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the rate of Ch$412=US$1.00, the average exchange rate for 1995.

[3]Chile's geographic regions are more fully described in the infrastructure section of this report.

Major Sources of Information

Ministerio de Mineria
Teatinos 120 Piso 9, Casilla 54, Correo 21
Santiago, Chile
Telephone: 56-2-6714373; 56-2-6986593
Fax: 56-2-6989262

Comision Chilena del Cobre (COCHILCO)
Agustinas 1161 Piso 4, Casilla 9493
Santiago, Chile
Telephone: 56-2-6726219
Fax: 56-2-6723584

Servicio Nacional de Geologia y Mineria (SERNAGEOMIN)
Ave. Santa Maria 0104, Casilla 1046
Santiago, Chile
Telephone: 56-2-6375050
Fax: 56-2-6372026

Major Publications

COCHILCO: Estadisticas del Cobre y otros Minerales.
CODELCO: Annual Report.
SERNAGEOMIN: Anuario de la Mineria de Chile.

TABLE 1
CHILE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS						
Arsenic trioxide		6,820	6,020	6,200 e/	6,300 e/	6,400
Copper:						
Mine output, Cu content 3/	thousand tons	1,814	1,933	2,055	2,220	2,488 4/
Metal:						
Smelter, primary 5/	do.	1,150 r/	1,160 r/	1,205 r/	1,234 r/	1,280 4/
Refined: 6/						
Fire-refined, primary	do.	120 r/	136 r/	155 r/	201 r/	358 4/
Electrolytic	do.	1,108 r/	1,106 r/	1,113 r/	1,076 r/	1,127 4/
Total	do.	1,228 r/	1,242	1,268 r/	1,277 r/	1,485 4/
Gold, mine output, Au content	kilograms	28,900	33,800	33,600	38,786	39,180
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	8,690	7,640	7,010	8,341 r/	8,174 4/
Fe content	do.	5,820	5,120	4,390	5,223 r/	5,119 4/
Metal:						
Pig iron	do.	703	873	917	883 r/	850
Ferroalloys:						
Ferrochromium		2,509	2,110	680	1,579 4/	2,730 4/
Ferromanganese		6,779	7,460	8,916	8,500 e/	8,500
Ferromolybdenum		2,673	2,310	2,202	2,300 e/	2,300
Ferrosilicomanganese		1,674	1,564	1,612	1,700 4/	1,600
Ferrosilicon		5,516	3,830	7,550	5,600 e/	5,600
Total		19,151 r/	17,274 r/	20,960 r/	19,653 r/	19,500
Steel, crude 7/	thousand tons	807	1,010	1,060	1,030 r/	1,013
Semimanufactures	do.	587	776	816	742 r/	779
Lead, mine output, Pb content		1,050	298	344	1,008	1,010
Manganese ore and concentrate:						
Gross weight		43,800	49,900	63,000	62,870	62,000
Mn content		13,233	14,915 4/	18,771 4/	18,175 4/	17,900 4/

See footnotes at end of table.

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TABLE 1--Continued
CHILE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS--Continued:						
Molybdenum:						
Mine output, Mo content		14,400	14,500	14,900	16,028 r/	17,889 4/
Oxides		10,700	10,400	10,500 e/	11,300 e/	13,300
Rhenium, mine output, Re content e/	kilograms	6,500	6,600	6,400	6,000	5,500
Selenium e/	do.	50,600 4/	50,000	49,500	45,000	46,000
Silver		678	1,030	970	983 e/	1,032 4/
Zinc, mine output, Zn content		30,998 r/	29,730 r/	29,435 r/	31,038 r/	30,000
INDUSTRIAL MINERALS						
Barite		3,153 r/	2,514	2,035	3,670 r/	3,000
Bentonite		1,054	1,081	989	1,213	1,000
Borates, crude, natural (ulexite)		97,135	202,716	117,072	85,935 r/	90,000
Cement, hydraulic	thousand tons	2,251	2,645 r/	3,021 r/	2,995 r/	2,900
Calcite (chalk)		4,000	4,890	5,650 r/	6,300 r/	6,300
Clays						
Cimita		2,600	405	-- r/	-- r/	--
Kaolin		63,083	59,083	66,939	73,081 r/	70,000
Other (unspecified)		16,000	20,300	17,000	37,600	30,000
Diatomite		5,560	5,900	5,770	10,129	10,000
Dolomite		--	--	--	47,287	48,000
Feldspar		4,010	5,740	4,150	9,967 r/	10,000
Gypsum:						
Crude	thousand tons	336	424	511	552	550
Calcined	do.	118 r/	161 r/	190 r/	201	200
Iodine, elemental		5,447	5,839	5,550 e/	5,600 e/	5,000
Lapis lazuli	kilograms	450	138	250	220	200
Lime, hydraulic e/	thousand tons	1,200	1,300	1,300	1,250	1,006 4/
Lithium carbonate		8,575	10,823	10,369	10,439	14,000
Nitrogen, natural crude nitrates:						
Sodium ($NaNO_3$)	thousand tons	473	515	532 e/	500 e/	500
Potassium (KNO_3)	do.	317	331	342 e/	300 e/	300
Total	do.	790	846	874 e/	800 e/	800
Phosphates:						
Guano		1,308	139	-- r/	-- r/	--
Rock (apatite)		13,338	17,546	14,560	9,975 r/	10,000
Total		14,646 r/	17,685 r/	14,560 r/	9,975 r/	10,000
Pigments, mineral, natural, Iron oxide		6,761	22,945 r/	7,106 r/	3,283 r/	3,000
Potash, K_2O equivalent e/		55,000	55,000	55,000 4/	50,000	50,000
Potassium chloride (KCL)		58,000	58,800	60,000 e/	55,000 e/	55,000
Pumice (includes pozzolan)	thousand tons	321	385	448	452 r/	450
Quartz, common	do.	486	484	459	543 r/	500
Salt, all types	do.	1,680	1,670	1,440	3,178 r/	3,000
Sodium compounds, n.e.s.: Sulfate e/ 8/		33,800 4/	46,400	46,400	46,400	47,000
Sand and gravel (silica) e/	thousand tons	300	300	300	300	300
Stone:						
Limestone (calcium carbonate)	do.	3,400	4,890	5,650	6,300	6,300
Marble		1,170	894	872	2,376 r/	2,000
Sulfur:						
Native, other than Frasch:						
Refined		16,884 r/	24,034	444 r/	-- r/	--
Caliche		-- r/	-- r/	493 r/	-- r/	--
Byproduct, (from smelters and oil refining)		278,000	306,000	385,000	350,000 e/	360,000
Total		294,884 r/	330,034	385,937	350,000 r/	360,000
Talc		548 r/	1,493	5,058	5,351 r/	5,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous and lignite	thousand tons	2,760 r/	2,125 r/	1,800 r/	1,667 r/	1,500
Coke, coke oven e/	do.	400 4/	300	350	350	350
Gas natural:						
Gross	million cubic meters	4,067	4,038	4,196	4,244 r/	4,300
Marketed	do.	1,772 r/	1,999	1,951 r/	2,185 r/	2,000

See footnotes at end of table.

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TABLE 1--Continued
CHILE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
MINERAL FUELS AND RELATED MATERIALS--Continued:						
Natural gas liquids: e/						
Natural gasoline	thousand 42-gallon barrels	746 4/	690	680	650	640
Liquefied petroleum gas	do.	2,090 4/	2,000	1,970	2,000	2,100
Total	do.	2,836 4/	2,690	2,650	2,650	2,740
Petroleum:						
Crude	do.	6,500	5,420	5,190 r/	4,492 r/	3,800
Refinery products:						
Liquefied petroleum gas	do.	2,500	7,740	7,930	8,000 e/	6,000
Gasoline:						
Aviation	do.	109	53	53	50 e/	50
Motor	do.	12,500	13,300	13,600	13,400 e/	13,500
Jet fuel	do.	2,290	2,380	2,440	2,400 e/	2,450
Kerosene	do.	1,650	2,190	2,250	2,300 e/	2,350
Distillate fuel oil	do.	15,200	17,900	18,400	18,500 e/	18,450
Residual fuel oil	do.	8,490	1,770	1,810	1,800 e/	1,900
Unspecified	do.	3,470	2,080	2,120	2,100 e/	2,200
Total	do.	46,209 r/	47,413	48,603	48,550 e/	46,900

e/ Estimated. r/ Revised.

1/ Table includes data available through Sept. 1996.

2/ In addition to the commodities listed, pyrite is also produced, but available information is inadequate to make reliable estimates of output levels.

3/ Figures are the nonduplicate copper content of ore concentrates, cement copper, slags and minerals, and copper as a byproduct measured at the last stage of processing as reported by Comision Chilena del Cobre. Mine production reported by Servicio Nacional de Geologia y Mineria was as follows, in thousand metric tons: 1993--2,078; 1994--2,234; and 1995--2,510.

4/ Reported figure.

5/ Detailed statistics on electrowinning are now available and reported by the International Copper Study Group Copper Bulletin (Jan. 1996) as follows, in metric tons: 1991--146.1 (revised); 1992--166.6 (revised); 1993--183.8 (revised); 1994--225.5 (revised); and 1995--358.9.

6/ Figures are total refined copper distributed into two classes according to method of refining, fire-refined and electrolytic, which includes electrowon copper refined in Chile, as reported by the Chilean Copper Commission.

7/ Excludes castings.

8/ Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

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TABLE 2
CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal (bituminous)	Empresa Nacional del Carbon, S.A. (ENACAR), CORFO's subsidiary (40% Government, 60% private)	Regions VIII, X and X11	1,300.
Do.	Carbonifera Schwagner, S.A. (61%; Agencias Universales, S.A., 39%; 1,500 private shareholders)	Regions X and XII	170.
Do. (subbituminous coal)	Cia. de Carbones de Chile, S.A. (COCAR) [(Cia. de Petroleos de Chile, S.A., 81%; International Finance Corp. (I.F.C.) (U.S.), 10% and Northern Strip Mining Ltd. (U.S.), 9%)]	Region XII Isla Riesco	1,300.
Copper	Corporacion Nacional del Cobre de Chile (CODELCO-Chile) (100% Government owned)	Mines:	
		Chuquicamata	580
		El Teniente	320
		Andina	145
		Salvador	85.
		Total	1,130
Do.	Do.	Smelters:	
		Chuquicamata	460.
		El Teniente	360.
		El Salvador	140.
		Total	940.
Do.	Do.	Refineries	
		Chuquicamata (sulfide)	600.
		Chuquicamata (oxide)	85.
		El Salvador	130.
Do.	Do.	SX-EW plants:	
		Chuquicamata (oxide)	130.
		El Salvador	1.
		El Teniente	2.
Do.	Do.	Sulfuric acid plants:	
		Chuquicamata (3 plants)	830.
		El Teniente	30.
Copper	Empresa Minera de Mantos Blancos S.A. (private 100%; Anglo-American Corp., 88%; IFC, 12%)	Plant,Mantos Blancos	90.
Do.	Do.	Smelter, Antofagasta	30.
Do.	Do.	SX-EW plant, Mantos Blancos	20.
Do.	Do.	Sulfuric acid plant:	
		Mantos Blancos (shutdown)	200.
Do.	Empresa Minera Escondida Ltda. (BHP, 57.5%; RTZ Corp. PLC, 30%; JECO, 10%; IFC, 2.5%)	Escondida, Km 135 caminos	800 Cu.
		Socompa, Antofagasta	3,300 (Kg. Au).
Copper, gold, and silver	Empresa Nactional de Mineria (ENAMI) (100% Government owned)	Plants:	270.
		Taltal, Salado, Matta, Vellenor Chancado	
Do.	Do.	Smelters:	
		Las Ventanas	145.
		Paipote	80.
Do.	Do.	Refinery:	
		Las Ventanas	200.
Do.	Do.	SX-EW plants:	
		Vallenar, Chancado	20.
Do.	Do.	Sulfuric acid plant:	
		Ventanas	225.
Do.	Exxon's Cia., Minera Disputada de-Las Condes, S.A. (Exxon, U.S. 87%, ENAMI 13%)	Mines:	
		Las Bronces	70.
		El Soldado	60.
		El Cobre	18.
Do.	Do.	Smelter:	
		Chagres	75.
Do.	Do.	Sulfuric acid plant, Chagres	100
Do.	Do.	SX-EW plan, Tortolas:	3.

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TABLE 2- Continued
CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Cia. Minera San Jose, Ltda. owned by Barrick Gold Corp. of Canada, 83%.	El Indio and El Tambo. Alto Panuelas, Coquimbo	5,900 Au. 2,600 Au.
Do.	do.	CODELCO-Chile (byproduct from copper) (Government, 100%)	Chuquicamata El Tenieante, El Salvador and Andina	2,200.
Gold and Silver	do.	Cia. Minera El Bronce-de Petorca (Private 100%)	Carmencita 240, Las Condes Santiago, Chile	52,700 Au.
Iodine	metric tons	Sociedad Quimica y Minera de Chile, Subsidiary of CORFO (Government, 35%; private, 65%)	Miraflores No. 222, Santiago	5,500.
Potassium nitrate		Do.	Planta Maria Elena, Maria Province	250.
Sodium nitrate		Do.	Planta Pedro de Valdivia, Pedro de Valdivia Province	600.
Sodium sulfate		Do.	Oficinia Antofagasta, Anibal Pinto 3228	70,000.
Iron ore		Cia Minera del Pacifico, S.A., CAP's subsidiary (100% private)	Pedro Pablo Munoz 675, La Serena Province	8,400.
Iron ore pellets		Do.	Minas El Romeral, El Algarrobo, Planta de Pellet, La Serena Province	4,000.
Lead and zinc		Soc. Contractural Minera El Toqui Ltda., (LAC Minerals of Canada, 100%)	Las Urbinas No 53, Providencia, Santiago	1.0 lead 31.0 zinc.
Lithium carbonate		Soc. Chilena de Litio Ltda. (subsidiary of Cyprus Foote Minerals Co. of the United States) (100% private)	Huerfanos 669, Santiago	8.6.
Molybdenum		CODELCO-Chile (byproduct from copper) (Government, 100%)	Huerfanos 1,270, Santiago	14.4.
Natural gas	million cubic feet	ENAP subsidiary of CORFO (Government, 100%)	Ahumada 341, Santiago	4.
Petroleum	million barrels	Do.	do.	6.5.
Silver	kilograms.	CODELCO-Chile (byproduct from copper)	Huerfanos 1270, Santiago	235,000.
Do.	do.	Cia Minera San Jose, Ltda. El Indio Mine, Barrick Gold Corp.of Canada, 83%)	Barrio Industrial, Alto Panielas, Coquimbo	48,000.
Steel		Cia. Siderurgica de Huachipato S.A., CAP subsidiary (100%, private)	Huerfanos 669, Santiago	800.

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TABLE 3
Chile: Major Mineral Investments 1994-97e/

Region	Project	Commodity	Owner(s)	Investment ($millions)	Startup date
I	1. Cerro Colorado	Copper	Rio Algom (Canada)	60	1996
I	2. Quebrada Blanca (expansion	do.	Comminco, Ltd., and Teck Resources Intnl. Ltd. of Canada, Pudahuel and ENAMI of Chile.	373	1996
I	3. Collahuasi (Ujina and Rosar	do.	Falconbrige Ltd. and Minorco Plc.(Canada) Minorco.	1,760	1997
II	4. El Abra	do.	Cyprus AMAX (U.S.), CODELCO (Chile)	1,000	1997
II	5. Zaldivar	do.	Outokumpu (Findland), Placer Dome (Can.)	600	1995
II	6. Leonor	do.	Equatorial Treasure Ltd. (Australia)	100	1997
II	7. Santa Barbara (expansion)	do.	Mantos Blancos S.A. (Chile) and Anglo American (South Africa)	160	1995
II	8. Lomas Bayas	do.	Gibraltar Mines Ltd. (Canada)	200	1997
II	9. Escondida (expansion)	do.	BHP (Australia), RTZ (U.K.) JECO (Japan), IFC (U.S.)	1,100	1997
II	10. Yolanda	Nitates/iodine	KAP Resources Ltd. (Canada) 10224 Yukon Ltd. (Canada)	89	1997
II	11. Minsal	Potassium chloride lithiium carbonate	Sociedad Quimica y Minera de Chile S.A. Soquimich (SQM)	290	1994
II	12. Ivan - Zar	do.	Rayroc Yellow knife Resources Inc. (Canada)	36	1996
III	13. Manto Verde	do.	Anglo American Corp.(South Africa) Minorco and Mantos Blancos Subsidiaries	180	1995
III	14 La Candelaria	do.	Phelps Dodge (U.S.), Sumitomo Corp. of Japan, Minorco Services Ltd. Falconbridge Ltd.	1,500	1994
III	15 Refugio	Gold	AMAX Gold Refugio Inc. (U.S.) Bema Gold (Canada)	130	1996
III	16. La Coipa	Gold/silver	Placer Dome (Canada) TVX Mining (Canada)	400	1992
IV	17. Los Pelambres (expansion)	Copper	The Luksic Group (Chile)	1,000	NA
IV	18. Andacollo Oro	do.	Andacollo Gold Inc. , La Serena Inc. (Dayton Mining Co. (Canada)	50	1996
IV	19. Nevada.	Gold	Cia. Minera San Jose Inc.	168	1997
	Tambo (Expansion)	do.	El Indio Property	105	1995
	Quebrada de Pascua	do.	American Barrick (Canada)	300	NA
XI	20. Fachinal	Gold/Silver	Coeur d'Alene Mines Corp. (U.S.)	85	1996

e/ Estimated. NA Not available.

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THE MINERAL INDUSTRY OF

COLOMBIA

By Ivette E. Torres

The economy of Colombia continued to grow in 1995. In the last 3 years, the gross domestic product (GDP) has increased by at least 5% per year. Growth in 1995 was 5.2%. Inflation was 19%, a decrease from that of 1994. In 1995, mining and quarrying and construction contributed to 5.5% and 6.5% of the GDP, respectively. Colombia's total exports increased to $9.7 billion during the year. Coal, ferronickel, and petroleum and its refinery products were part of Colombia's traditional exports sector. According to statistics of the Banco de la República, in 1995, foreign investment in Colombia, excluding the petroleum sector, totaled $7.3 billion, a 27% increase from that of 1994. Foreign investment in the mining sector was almost 24% of the total. The United States was the largest foreign investor, with about 56% of the total, followed by the European Union with 13% of the total. Although the country's economic growth is one of the highest in Latin America and interest by foreign investment has increased significantly, violence, security, and drug-related issues continue to be of domestic and international concern. In 1995, Colombia was ranked as Latin America's least stable country because of political and social risk factors.[1]

The Government of Colombia announced plans to privatize 28 companies by 1998. It planned to sell its share of two mineral-producing companies, the coal producer Carbones de Colombia S.A. (CARBOCOL) and the nickel producer Cerro Matoso S.A.[2] The Government, however, agreed not to sell major parts of the oil producing company Empresa Colombiana de Petróleos S.A. (Ecopetrol).[3] This was decided after negotiations among Ecopetrol, the Ministry of Mines and Energy, and the National Oil Workers Union. Refining operations, where the Government maintains a monopoly through Ecopetrol, and gas pipelines were parts of Ecopetrol that the Government still was planning to privatize at yearend 1995. Eight gas distribution and electricity generating companies were scheduled for sale with an approximate value of $250 million.[4] The companies are Promigas, Gas Natural, Colgas, Invercolsa, El Terpel de Antioquía, and three thermal generating plants.

Colombia is a major producer of a selected group of minerals. In 1995, the country continued to be one of the dominant producers of emeralds. It was the fourth largest producer of platinum, with about 1% of the world total. To a lesser extent, it was also a significant producer of coal, gold, nickel, natural gas, petroleum, and refinery products. A variety of other metal and industrial minerals were produced in Colombia although in modest amounts by world standards. In general, minerals were produced by both the public and the private sectors.

In terms of value, coal, nickel, and petroleum and refinery products together accounted for almost 30% of Colombia's total exports, with petroleum and its refinery products being by far the most significant of its mineral exports. The value of metals and nonmetals accounted only for about 4% of the total, while that of mineral ores and concentrates was less than 1%.

Colombia's production of gold increased slightly in 1995 to 21,160 kilograms, but it was still almost 40% below the level achieved in 1990. In world context, this level of production ranked Colombia among the top 20 producers (16th). In Latin America, Colombia was the fourth leading producer of gold in 1995 after Brazil, Peru, and Chile. In August, Greenstone Resources Ltd., of Toronto, Canada, announced that it had sold its interest in the Oronorte project in Colombia to Fisher-Watt Gold Co., United States.

Cerro Matoso S.A. is the only producer of nickel in Colombia. The company, in production since 1982, is owned by Billiton Overseas Ltd., a subsidiary of GENCOR Ltd., South Africa (52.3%), and the Government of Colombia through Instituto de Fomento Industrial (IFI) (47.7%). In 1995, Cerro Matoso produced 24,565 metric tons (tons) of nickel in ferronickel, about 3% of the world total primary nickel. In terms of mine production in the Western Hemisphere, only Canada, Cuba, and the Dominican Republic produced more nickel than Colombia. Nickel mine production from Colombia represented about 2% of the total world production. Almost all of the ferronickel produced in Colombia is exported to Europe, India, Japan, and the United States. Cerro Matoso planned to expand production in 1996 to about 27,000 tons, with longer term plans for an output of more than 35,000 tons.

Production of steel in Colombia is very modest by world standards. In 1995, it ranked sixth in Latin America behind Brazil, Mexico, Argentina, Venezuela, and Chile and only produced about 1.5% of the crude steel output in the area. Output increased by about 15% from that of 1994 to 792,000 tons. The largest individual producer was Acerías Paz del Río S.A. in Boyacá Department was created in 1947 and privatized in 1954. It is the only

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integrated facility in the country, with almost 40% of the national output.[5]

In addition to Acerías Paz del Río, Colombia has five semi-integrated plants. Production from the semi-integrated sector is controlled by the Mayagüez Group, the largest collective producer with about 45% of the market, with three plants, Siderúrgica del Caribe, Siderúrgica del Muña, and Siderúrgica del Pacífico. Steel production in Colombia is oriented toward the domestic market, although small amounts of steel products have been exported in the past. Production in Colombia is not large enough to meet domestic demand. In recent years, apparent consumption of rolled steel products has averaged about 1 million tons while imports of iron and steel products have fluctuated between 368,000 tons and 812,000 tons.

Colombia's cement production increased slightly in 1995 to 9.6 million tons. Production capacity from 17 plants owned by 6 entities was 10.955 million tons.[6] The largest producer is the Argos group, which owns more than 50% of the cement capacity with eight cement companies and a grinding facility, followed by the Diamante group with about 18% of total capacity through four plants. Production in Colombia should continue to increase in the next few years to support Government plans to develop the country's infrastructure, including two dams, an expansion of the Bogotá airport, and an impressive plan for private (toll) roads. Accordingly, several companies have been investing to increase their production capacity. By 1997, production capacity should reach 14.470 million tons, a 32% increase from the existing capacity in 1995.[7]

Colombia is a premier producer of emeralds, producing a large proportion of the world's finest emeralds. Most of the emeralds were produced in the Boyacá Department. Official production in 1995 decreased about 13% to 6.3 million carats. Japan and the United States were the largest importers of Colombian emeralds. The U.S. imports of Colombian emeralds totaled 1.1 million carats in 1995, almost 18% of the official output.

Colombia is a small producer of coal with an output of less than 1% of the world production, but it exports about 80% of its production making it one of the leading exporters of coal in the world. Production in 1995 reached 26 million tons, a 15% increase from that of 1994. Exports increased in value and represented the third largest source of foreign exchange after coffee and petroleum.

The Government company Empresa Colombiana de Carbón Ltda. responsible for administering Colombia's coal sector since 1993, planned to increase Colombia's relevance in the world coal industry. With the largest resources in Latin America, and already having a significant position in trade, in particular to Europe, the United States, and other Latin American countries, Colombia directed its plans to maintaining existing markets, to expanding to new export markets, and to increasing its domestic market, while increasing production capacity and investing in infrastructure to achieve those goals.

The largest producer and exporter of Colombian coal, with a design capacity of 15 million tons per year, is El Cerrejón Norte project, a joint venture between CARBOCOL and Exxon Coal and Minerals Co.--through International Colombia Resources Corp.[8] The company plans to expand production capacity to 21 million tons per year were still being considered without a final decision being made by yearend.

In mid-1995, production began at the Mina Pribbennow (formerly La Loma mine) by Drummond Ltd. Plans for the mine, scheduled to produce less than 2 million tons for the year, called for a significant expansion of facilities to become the second largest coal producer in Colombia by the end of the century, with an anticipated capacity of 10 million tons. The mine's recoverable reserves exceed 485 million tons.[9]

At yearend 1995, RTZ Corp. (RTZ) and Carbones del Caribe S.A., a subsidiary of Cementos del Caribe S.A., completed negotiations for a $36 million investment in Oreganal S.A., a small coal producer in the Cerrejón Central Zone.[10] The agreement would give RTZ a 75% interest in Oreganal, with Carbones del Caribe retaining the remaining 25%. Production at the mine was about 500,000 tons in 1995. RTZ planned to increase the production to about 6 to 7 million tons per year. A feasibility study was planned for 1996.

Prodeco, also in Cerrejón Central Zone, also had plans for expansion.[11] The company planned to double its production and exports to 6 million tons per year and 4 million tons per year by yearend 1996, respectively. The company's investment in 1995 included opening of new mining areas and upgrading equipment. The company also planned to upgrade infrastructure and improve port facilities to increase capacity to 5 million tons per year.

The Government company responsible for the petroleum sector in Colombia is Ecopetrol. Production of crude and natural gas is carried out by Ecopetrol individually or in association with the private sector, while the production of refinery products is reserved for Ecopetrol. In 1995, these associations, with participation from Ecopetrol, dominated the reserves, exploration, production, and investment of crude oil and natural gas. However, exports of crude oil were distributed almost equally between Ecopetrol and the associations.

Production of crude oil increased by almost 30% to 213.4 million barrels in 1995. The increase, mainly due to the new production from wells in the Cusiana and Cupiagua fields, is in tone with Colombia's plans to become a major world oil producer and exporter in the near future. In 1995, Colombia was the fifth largest producer of crude oil in Latin America after Mexico, Venezuela, Brazil, and Argentina. At yearend, Colombia's reserves of crude oil totaled 2,952 million barrels.[12]

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Exports of crude more than doubled during the year, representing an increase of more than 30% from the previous record-high level achieved in 1990. Investment in production was $775 million. Of this, Ecopetrol's contribution in its 50% share of established associations and in direct investment totaled $400 million. Investment in exploration was $308.1 million, 90% of which was from companies in association. The remainder was direct investment by Ecopetrol.

During the year, several changes were made to the petroleum contract policies. The changes were aimed at making exploration and production of oil and natural gas more attractive to foreign investors while giving more flexibility to Ecopetrol in doing business in association contracts. Among them were (1) the reimbursement of 50% of the direct costs in perforation and seismic exploration prior to each discovery, (2) the possibility of extending the terms of association contracts effective after September 1995 if request is submitted 5 years prior to their expiration date, (3) the chance for Ecopetrol to negotiate its participation in existing fields determined to be marginal, (4) a new model of shared-risk contract applicable in some areas assigned for the direct involvement of Ecopetrol that merit sharing the costs and risks of investment, and (5) the elimination of war taxes for fields discovered or declared commercial on or after January 1995.

In July, British Petroleum Exploration Co. Colombia Ltd. (BP Colombia) announced the discovery of two new oilfields and gasfields, the Floreña and Pauto Sur, near the Cusiana field.[13] The fields reserves were being evaluated at yearend. The Cusiana-Cupiagua project, in the Santiago de Las Atalayas, Tauramena, and Río Chitamena association contract areas, which began production in 1994 and are being rapidly developed, is central to Colombia's plans to expand its oil sector. Ecopetrol holds 50% interest in the project, with BP Colombia (19%), TOTAL (19%) Triton Colombia Inc. (12%) holding the remainder. In 1995, work began on the second stage of development (phase 2), which plans to increase the production level of Cusiana-Cupiagua to more than 500,000 barrels per day by yearend 1997.[14] Therefore, production from this area would represent almost the same level of the total country production achieved in 1995. Almost 80% of Ecopetrol's investment in production in 1995 went to the Cusiana field, which reached a production level of 128,000 barrels per day. In 1997, when full development in the Cusiana-Cupiagua area is achieved, Cusiana is expected to produce 320,000 barrels per day; and Cupiagua, which is expected to be in production during that year, should reach a production level of 200,000 barrels per day.

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Major Sources of Information

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TABLE 1
COLOMBIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS						
Bauxite e/		1,720 2/	1,750	1,700	1,700	1,700
Copper, mine output, Cu content		3,640	3,940	-- r/	11,894 r/	11,398
Gold	kilograms	34,730 r/	32,117	27,471	20,762 r/	21,160
Iron and steel:						
Iron ore and concentrate	thousand tons	450	674	545	610	734
Pig iron	do.	305	308 r/	238 r/	244	282
Steel, crude	do.	652	657	687	691 r/	792
Semimanufactures, hot-rolled	do.	581	590 e/	636	642	692
Lead:						
Mine output, Pb content		611	620	447	290 r/	300 e/
Refined (secondary) e/		3,600	3,600	3,600	3,500	3,500
Manganese, mine output, Mn content		552	600 e/	800	220 r/	1,000
Nickel:						
Mine output, Ni content		23,048 r/	23,347 r/	22,831 r/	26,141 r/	24,194
Ferronickel, Ni content		20,194	20,195	20,181 r/	20,833	24,565
Platinum-group metals	kilograms	1,603	1,956	1,722	1,084	973
Silver	do.	8,037	8,292	7,328	5,899 r/	5,913
Zinc, mine output, Zn content		266	277	279	275 e/	275 e/
INDUSTRIAL MINERALS						
Asbestos:						
Mine output		160,000	170,000	--	--	--
Fiber		7,830	7,900	--	--	--
Barite		9,290	9,380	4,840	7,000	21,300
Cement, hydraulic	thousand tons	6,300	6,810	7,930 r/	9,322 r/	9,624
Clays:						
Bentonite		3,180	3,260	-- r/	1,018 r/	9,000
Common clay and kaolin	thousand tons	1,980	2,050	2,097	6,700 r/	7,300
Diatomite		3,890	4,360	4,400 e/	4,000 e/	4,000 e/
Feldspar		45,600	78,400	60,458	76,188 r/	58,100
Fluorite		894	959	1,800	800 r/	720
Gemstones: Emerald 3/	thousand carats	1,080	2,310	5,150	7,202	6,304
Gypsum	thousand tons	639	671	439	450	450 e/
Lime, hydrated and quicklime e/	do.	1,300	1,300 r/	1,300 r/	1,300 r/	1,300
Magnesite		18,768	18,840	8,816 r/	10,747 r/	10,500
Mica		50	54	55 e/	55 e/	55 e/
Nitrogen, N content of ammonia e/		91,900	86,300	98,500	90,000	90,000 e/
Phosphate rock		31,500	31,500	44,994 r/	48,107 r/	50,000
Salt:						
Rock	thousand tons	219	230	231	315 e/	315 e/
Marine	do.	482	317	169	250 e/	250 e/
Total	do.	701	547	400	565 e/	565 e/
Sodium compounds, n.e.s., sodium carbonate e/		121,000 2/	121,000	121,000	121,000	121,000
Stone and sand:						
Calcite		5,760	6,320	6,500 e/	6,500 e/	6,500 e/
Dolomite	thousand tons	46	46 r/	45 e/	45 e/	45 e/
Limestone	do.	15,700	16,000 e/	15,701 r/	14,000	19,248
Marble		33,400	34,600	34,500 e/	35,000 e/	35,000 e/
Sand excluding metal-bearing e/		859,000 2/	860,000	850,000	850,000	900,000
Sulfur:						
Native (from ore)		37,600	39,200	51,396	53,357	60,000
Byproduct, from petroleum e/		9,000	9,200	12,200	12,200	15,000
Total		46,600	48,400	63,596	65,557	75,000
Talc, soapstone, pyrophyllite		11,100	13,300	19,550	18,000 r/	19,248
MINERAL FUELS AND RELATED MATERIALS						
Carbon black e/		20,000	23,600 2/	23,800	24,000	24,000
Coal:						
Metallurgical e/	thousand tons	800	900	1,800	2,000	2,000
Steam	do.	19,200	22,900	19,423 r/	20,665 r/	24,020 e/
Total	do.	20,000	23,800	21,223 r/	22,665 r/	26,020
Coke, all types e/	do.	400	450	632 2/	562 2/	600
Gas, natural:						
Gross	million cubic meters	5,200	5,200 e/	5,334 r/	5,423 r/	7,674
Marketed	do.	4,250	4,450 e/	4,360 r/	4,430 r/	5,000 e/
Natural gas liquids e/	thousand 42-gallon barrels	2,240 2/	2,300	2,300	2,500	2,500

See footnotes at end of table.

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TABLE 1--Continued
COLOMBIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	155,329	160,600	165,762 r/	166,096	213,397
Refinery products:						
Liquefied petroleum gas	do.	4,264 r/	4,373 r/	4,080	6,203 r/	7,010
Gasoline:						
Aviation	do.	296 r/	288 r/	209	182 r/	250
Motor	do.	30,722 r/	31,245 r/	30,703	30,072 r/	26,459
Jet fuel	do.	4,136 r/	4,660 r/	4,835	5,328 r/	5,662
Kerosene	do.	1,812 r/	2,025 r/	1,746	1,437 r/	1,342
Gasoline:						
Distillate fuel oil	do.	17,206 r/	17,042 r/	19,207	20,612 r/	21,969
Lubricants	do.	350 r/ e/	438 r/	329 r/	372 r/	372
Residual fuel oil	do.	27,000 r/	24,461 r/	21,049 r/	19,886 r/	20,039
Asphalt and bitumen	do.	1,500 r/ e/	1,559 r/	1,852 r/	2,865 r/	2,964
Refinery fuel and losses and unspecified products e	do.	43,494 r/	43,873 r/	45,852 r/	46,239 r/	48,199
Total	do.	89,550 r/	87,373 r/	88,289 r/	89,974 r/	93,543

e/ Estimated. r/ Revised.
1/ Includes data available through Sept. 16, 1996.
2/ Reported figure.
3/ Based on registered exports by the Banco de la República.

TABLE 2
COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Carbon Black		Cabot Colombiana S.A. (private, 100%)	Cartagena, Bolívar Department (plant)	NA
Do.		Productos Petroquímicos S.A. (private, 100%)	Cali, Valle del Cauca Department (two plants)	12
Cement		Cía. Colombia de Clinker S.A. (Colclinker) (private, 100%)	Cartagena, Bolívar Department (plant)	1,100
Do.		Cementos del Caribe S.A. (private, 100%)	Barranquilla, Atlántico Department	1,000
Do.		Cementos del Valle S.A. (private, 100%)	Yumbo, Valle del Cauca Department	1,200
Do.		Cementos Río Claro S.A. (private, 100%)	Puerto Trifuno, Antioquía Department	1,000
Coal		Carbones de Colombia S.A. (CARBOCOL) (Government, 50%) and International Colombia Resources Corp. (Intercor) (Exxon, 50%)	El Cerrejón Norte Mine, La Guajra Department	15,000
Do.		Drummond, Ltd. (Drummond Co., 100%)	La Loma Mine, César Department	2,000
Do.		Prodeco (Private, 100%)	A number of mines in Central Colombia	1,000
Do.		Acerías Paz del Río S.A. (private, 100%)	Paz del Río, Boyacá Department (mine)	600
Copper		El Roble Exploración y Explotación S.A. (Minas El Roble, 51%; Nittetsu Mining, 44.1%; and C Itoh, 4.9%)	El Roble Mine, El Carmen, Chocó Department	4
Emerald		Minerales de Colombia S.A. (Government, 100%)	Chivor, Coscuez, Muzó, and Quípama Mines, Boyacá Department	NA
Gold	kilograms	Frontino Gold Mines Ltd. (private, 100%)	El Silencio Mine, Segovia, Antioquía Department	1,500
Do.	do.	Fisher-Watt Gold Co. (private, 100%)	Oronorte Mine, Segovia, Antioquía Department	500
Do.	do.	Mineros de Antioquía S.A. (private, 100%)	Río Nechí, near El Bagre, Antioquía Department (mines)	2,000

See footnotes at end of table.

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TABLE 2–Continued
COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold–Continued:	kilograms	Small miners (Cooperatives and individual prospectors)	Río Nechí, Antioquía Department (mines)	NA
Iron ore		Acerías Paz del Río S.A.	Paz del Río, Boyacá Department (mine)	800
Kaolin		Cerámicas del Valle Ltda., (private, 100%)	Yumbo, Valle del Cauca Department (mine)	NA
Natural gas	million cubic meters	Empresa Colombiana de Petróleos (Ecopetrol) (Government, 100%)	North coast, La Guajira Department (national gasfields)	3,500
Do.	do.	International Petroleum Colombia, Ltd. (International Petroleum Corp., 100%)	Barrancabermeja locale, Antioquía and Santander Departments	1,200
Nickel		Cerro Matoso S.A. (Billiton Overseas Ltd., 52.3 %, Government, 47.7%)	Cerro Matoso Mine, Montelíbano, Córdoba Department	23
Nitrogen		Abonos de Colombia (private, 100%)	Cartagena, Bolívar Department (plant)	100
Do.		Monomeros Colombo-Venezolanos S.A. (private, 100%)	Barranquilla, Atlántico Department (plant)	85
Petroleum	thousand 42-gallon barrels	Ecopetrol	16 fields in various departments	70,000
Do.	do.	Houston Oil Colombiana S.A. (HOCOL) (Royal Dutch Shell, 100%)	14 fields in various departments	36,500
Petroleum products	do.	Ecopetrol	Barrancabermeja Refinery, Santander Department	71,400
Do.	do.	Do.	Cartegena Refinery, Bolívar Department	25,806
Do.	do.	Do.	Tibú, Norte de Santander Department	1,825
Petroleum products	do.	Ecopetrol	Orito, Putumayo Department	875
Phosphate		Fosfatos de Colombia S.A. (private, 100%)	Neiva, Huila Department	30
Do.		Fosfatos Boyacá, S.A (Government, 100%)	Iza, Boyacá Department	20
Platinum		Small miners (Cooperatives and individual prospectors)	Río San Juan, Chocó Department	NA
Salt: marine		Instituto de Fomento Industrial (IFI) (Government, 100%)	Manaure Salina, La Guajira Department	700
Rock		Concesión Salinas (Government, 100%)	Zipaquira, Cundinamarca Department	500
Silver	kilograms	Frontino Gold Mines Ltd.	Segovia, Antioquía Department (mine)	2,500
Do.	do.	Small miners (Individual prospectors and cooperatives)	Río Nechí, Antioquía Department (mines)	2,000
Steel: Intergrated plant		Acerías Paz del Río S.A.	Belencito, Boyacá Department	400
Semi-intergrated plants		Siderúrgica del Caribe (private, 100%)	Cartagena, Bolívar Department	NA
Do.		Siderúrgica del Boyacá S.A. (private, 100%)	Bogotá, Federal District	NA
Do.		Siderúrgica del Medellín S.A. (private, 100%)	Medellín, Antioquía Department	NA
Do.		Siderúrgica del Muña S.A. (private, 100%) (Private, 100%)	Chusacá, Federal District	NA
Do.		Siderúrgica del Pacífico S.A. (private, 100%)	Cali, Valle del Cauca Department	NA
Sulfur		Industrias Purace S.A. (private, 100%)	El Vinagre Mine, Cauca Department	60
Do.		Ecopetrol	Barrancabermeja, Santander Department	29

NA Not available.
1/ Under development.

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THE MINERAL INDUSTRY OF

COSTA RICA

By David B. Doan

The production of minerals in Costa Rica contributed less than 1% to the Nation's gross domestic product. Mining was governed by Law 6797 of 1982. The Ministerio de Recursos Naturales, Energia y Minas was responsible for the control and development of Costa Rica's mineral resources through the Direccion de Geologia Minas y Hidrocarburos, the Minera Nacional, S.A. (MINASA), and the National Environmental Commission. MINASA coordinated mineral industry activities between Government agencies and the private sector.

The Government-owned Refinadora Costarricense de Petroleo, S.A. (RECOPE) controlled oil-refining operations, but operating companies were mostly privately owned. A 1994 law promoted exploration and production of hydrocarbons through negotiated contracts, good for 3 years plus three 1-year renewal options. Nonrenewable production contracts could last for 20 years before expiration.[1] An "Environmental Action Plan", newly promulgated by the Government, included fines for violations of its management policies.

Production of gold, with silver as a byproduct, was primarily in Abangares District of the Central Gold Belt of the Tilaran Cordillera in the northwest. The major gold producer was the Tres Hermanos underground mine, 110 kilometers (km) northwest of San Jose, operated by El Valiente Ascari A.S., a subsidiary of Ariel Resources Ltd. of Vancouver, Canada. Ariel also operated the San Martin undergound mine and the Matapalo mill. The company reported that total gold reserves were approximately 800,000 ounces (24,883 kilograms)(kg). The El Recio deposit in the Abangares gold mining district, held by Greenstone Resources Ltd., of Canada, was sold to Ariel Resources for shares of Ariel and a net-profits interest of 10%, expandable to 30% after certain conditions were met.[2] Minera Rayrock Inc., of Canada, continued development of its Bellavista property, northwest of San Jose, and reported reserves of 1,960,000 ounces (60,964 kg) of gold. Placer Dome Inc., of Canada, explored in the far northwest near the Nicaraguan border.

Taiwan's Kao Chieh Group disclosed plans to proceed with development of a $15-million manganese mine and mill in Guancaste Province.

Industrial mineral production included cement, clays, diatomite, lime, pumice, salt, sand and gravel, and crushed stone. (*See table 1.*) Of 13 known diatomite deposits stretching from Liberia to Cartago, only the Loma Camastro deposit, northeast of Liberia, was being mined. About 20% of mined limestone was used to produce aggregate, dimension stone, and lime. Cementfabrik Holderbank AG, a Switzerland-based cement producer, was the largest shareholder (44%) in the INCSA, which had about 290 employees. Holderbank also had a 65% interest in the concrete producer Productos de Concreto S.A., San Jose, with 1,160 employees.[3] Limestone was quarried primarily for the use in the manufacture of cement by Cementos del Pacifico S.A. and Industria Nacional de Cemento S.A. Fertilizers were produced by Fertilizanates de Centro America S.A., the largest producer in Central America. Salt was produced by the solar evaporation of brine, primarily around the Golfo de Nicoya.

Crude oil for domestic refining was imported from Mexico and Venezuela, under the San Jose Petroleum Accords, as well as from Colombia and Venezuela, but most petroleum products were imported from the Netherlands Antilles and the United States. RECOPE operated the country's oil refinery. Cement plants were owned by the Government and by private firms.

Canadian and U.S. companies were involved in a number of gold and silver exploration and mining operations. (*See table 2.*)

Foreign investors were encouraged to explore for gold deposits, modernize old mines, open new mines, and to explore for petroleum. The Government expected to continue its improvement of infrastructure and environmental management, as well as divestment of several major state companies.

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[1]World Oil (Houston, Texas): Aug. 1994, p. 36

[2]Ariel Resources Ltd. (Vancouver): News Releases and quarterly reports, Jun. 30 through August 30,1995.

[3]Cementfabrik Holderbank (Celigny): 1992 Annual Report.

Major Sources of Information

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Major Publications

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

TABLE 1
COSTA RICA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
Cement		700,000	700,000	860,000 r/	940,000 r/	990,000
Clays, common		399,000	400,000	400,500	401,000	410,000
Diatomite		12,000	12,000	12,000	12,000	13,000
Gold	kilograms	550	550	600	358 3/	500
Iron and steel, semimanufactures		89,757 3/	85,000	86,000	87,000	89,000
Lime		8,655 3/	9,000	9,500	9,500	9,800
Petroleum refinery products	thousand 42-gallon barrels	2,500	3,000	4,000	4,000	4,400
Pumice		8,000	8,000	8,000	8,000	8,000
Salt, marine		50,000	50,000	45,000	45,000	47,000
Silver	kilograms	370	400	450	450	450
Stone, sand and gravel:						
Crushed rock and rough stone	thousand tons	944 3/	1,000	1,000	1,200	1,300
Limestone and calcareous materials	do.	1,300	1,300	1,500	1,700	2,000
Sand and gravel	do.	1,047 3/	1,100	1,200	1,400	1,500
Sandstone		650	650	700	800	850

r/ Revised.
1/ Estimated data are rounded to three significant digits.
2/ Table includes data available through May 1, 1996.
3/ Reported figure.

TABLE 2
COSTA RICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement		Industria Nacional de Cemento, S.A. (INCSA) (Private, 100%)	Aguas Calientes, Cartago, Cartago Province	425
Do.		Cementos del Pacífico, S.A. (CEMPASA) (subsidiary of Corporacion Costarricense de Desarrollo, S.A., Government, 100%)	Near Colorado, Guanacaste Province.	400
Clay		CEMPASA	Tajo Finca, near Platanar, Guanacaste Province	100
Gold	kilograms	El Valiente Ascari, S.A. (Ariel Resources, Ltd., Canada, 100%)	Tres Hermanos Mine, Las Juntas, Guanacaste Province	305
Do.	do.	Minera Macona, Ltd. (Equinox Resources, Ltd., 100%)	Santa Clara Mine, Puntarenas Province	160
Limestone		INCSA	La Chilena Quarry, near Cartago, Cartago Province	550
Do.		CEMPASA	Cerro Peña Blanca Quarry, Guamacaste Province	300
Petroleum products	thousand 42-gallon barrels	Refinadora Costarricense de Petróleo, S.A. (RECOPE)	Moin Refinery, Limón Province	5,760

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THE MINERAL INDUSTRY OF

CUBA

By Ivette E. Torres

Cuba continued to produce a modest amount of most mineral commodities in 1995. Metal commodities produced in Cuba included chromite, cobalt, copper, crude steel, and nickel. By far, the most important metal to the Cuban economy continued to be nickel. Cuba was the sixth leading producer of nickel in the world, producing about 5% of the total nickel mine production in 1995. Cuba's industrial mineral products included cement, gypsum, lime, ammonia, salt, silica sand, and sulfur. Marble and other construction materials were also produced in Cuba. Production of oil continued to be modest, and a significant portion of the island's oil requirements needed to be imported.

In 1995, Cuba, once highly dependent on the former Soviet Union, continued to adjust and change as a means to survive without the many subsidies that benefited its economy under the former Soviet Union. In recent years, the Government of Cuba has been cultivating various forms of foreign investment with mainly Canadian, European, and Latin American countries in areas such as tourism in an effort to stimulate its economy and increase its earnings of hard currency. In September 1995, the National Assembly approved the Foreign Investment Act (Law No. 77) an investment law to facilitate further investment by international corporations.[1] The new law, which supersedes Law No. 50 of 1982, opened all sectors of the economy to foreign investment.[2] The law covers joint ventures with domestic private and Government participation, contracts of international economic associations, and full participation of foreign capital without Cuban partners. The law also includes the term "Administrative concession" defined as a unilateral action on the part of the Government of the Republic granting an entity "the right to exploit a service or a natural resource, or to build or utilize public works under terms and conditions to be determined." The Government has only 60 days to approve or deny a request for foreign investment. The law offers a number of guarantees including (1) the possibility of requesting a time extension when the term of the joint venture or the foreign investment entity expires, (2) upon denial of extension, the liquidation of the joint venture or foreign investment entity and payment made in full convertible currency, (3) protection against claims from third parties and (4) free transference abroad of net profits or dividends, and moneys resulting from an expropriation (for reasons of national security only), expiration of the joint venture, and the sale or transfer of the foreign investor's share of the company.

The taxation in the law is not applicable to the payment obligations under the Mining Act of December 21, 1994 (chapter III of Law No. 77). Income taxes, which are levied at 30%, can be raised as high as 50% by the Executive Committee of Council of Ministers for the exploitation of renewable and nonrenewable resources (Chapter XII Law No. 77).

The Government, however, has indicated that the goal of joint ventures was not to privatize Cuba but to stimulate its economy, to improve existing technology and to create new sources of employment, and to gain better access to third markets.[3] At yearnend 1995, foreign investment in Cuba was $2.1 billion.[4]

According to the Government, the Cuban economy was expected to grow by 2.5% from that of 1994. In 1994 the economy grew 0.7% after 4 years of sharp decreases.[5]

Trade with Latin America and the Caribbean totals about 40% of Cuba's total trade.[6] About 50% of Cuba's exports in 1994 went to Russia, Canada, China, Egypt, Spain, Japan, and Morocco, in that order. In descending order, Spain, Mexico, France, China and Venezuela were the main suppliers of imports to Cuba during the same period.[7]

Output of nickel, the most important mineral commodity to the Cuban economy, increased significantly in 1995 after a 10% decrease in 1994. Activity in the industry was encouraged by high nickel prices and foreign participation that began at yearend 1994 when Sherritt Inc., of Canada, formed a 50-50 joint venture with Compañía General del Níquel S.A. through its subsidiary Sherritt International Corp. The agreement included mineral concessions and the operation of the nickel-processing plant in Moa. It also included the cobalt refinery in Fort Saskatchewan and International Cobalt Co., Sherritt's marketing and sales company. The Moa Bay plant, built in 1958 by Freeport Nickel Co., uses the acid-leaching process, which produces a nickel-cobalt sulfide. The operation is reportedly the most profitable of the nickel plants in Cuba because it requires low fuel input and higher cobalt in the sulfide.[8] Production from Moa in 1995 increased by 74% to 20,652 tons. However, at yearend, Sherritt disposed of its entire investment in Sherritt International Corp.[9] In June, the U.S. Department of the Treasury had included Sherritt Inc's. Cobalt Refinery Co. Inc. and International Cobalt Co. Inc. in Saskatchewan as "specially designated nationals

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of Cuba" and added them to the list of blocked persons and specially designated nationals. Because of this designation, Sherritt Inc. became subject to the same U.S. sanctions that apply to Cuba.[10] At the same time, the U.S. Congress was considering legislation to tighten the U.S. embargo against Cuba. No action had been taken by Congress at yearend.

In late 1995, Australia's Western Mining Corp. also entered into a joint-venture agreement with the Government-owned Commercial Caribbean Nickel S.A. to explore and develop the Pinares de Mayarí nickel deposit in Holguín Province, formalizing an agreement in principle that had been reached in September 1994. Funding of further infill drilling and the feasibility study for a mine would give Western Mining a 65% share of the joint venture. Western Mining would manage the project. Drilling was scheduled for early 1996, followed by metallurgical testing and possibly a pilot plant based on Sherritt Inc.'s high-pressure leach process, already being used at the Moa Bay plant. During the year, two South African companies, GENCOR and Anglo American Corp. were also discussing with Cuban Government entities opportunities in the nickel industry.[11]

Foreign companies were actively exploring Cuba in 1995. Joutel Resources Ltd. was carrying out several exploration projects for precious and base metals in the Sierra Maestra, Camagüey, and Santa Clara areas. Northern Orion Exploration was exploring two areas in Cuba. The Delita gold property in the Isla de Juventud was drilled to confirm the grade and thickness of the deposit.[12] Estimates from a prefeasibility study indicated geological resources of 18.9 million tons grading 2.87 grams of gold and 33 grams of silver per ton. Within this resource, 4.7 million tons grading 4.1 grams and 22 grams of silver per ton could be mined by open pit methods and 1.9 million tons grading 5.4 grams of gold and 25 grams of silver could be mined by underground methods. A feasibility study was scheduled for 1996. Northern Orion also had a 50% interest in the Mantúa copper-gold deposit in Pinar del Río.[13] The deposit consists of a gossan with 1.44 grams of gold and 11.65 grams of silver per ton and an underlying minable copper zone with 15.2 million tons grading 1.35% copper, within it 6.2 million tons of the reserves graded 2.8% copper. Results of a feasibility study were being evaluated by the company at yearend.

CaribGold Resources and MacDonald Mines Exploration Ltd. together with Golden Hill Mining Corp. were among other companies exploring on the island.

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[1]Law Number 77 Foreign Investment Act. Ministry for Foreign Investment and Economic Cooperation, 1995.

The Cuban Investment Letter (Canada). Winter 1995, p. 1.

[3]Granma International (Havana). Doors Open to Foreign Investment. Y. 30, No. 35, Sept.6, 1995, p. 6.

[4]Work cited on footnote 2.

[4]Granma International (Havana). Sherritt Incorporated Will Make New Investments. Y. 30, No. 44, Nov. 8, 1995, p. 1.

[5]The Journal of Commerce. Cuba Releases Details of Its External Debt. Nov. 20, 1995, p. 8A.

[6]Work cited on footnote 2.

[7]Central Intelligence Agency. The World Factbook 1995, p. 109.

[8]Cuba Turns to the Pragmatists. Sec. in 1995 E&MJ International Directory of Mining. Engineering and Mining Journal, 1994, pp. 172-175.

[9]Sherritt Inc's. 1995 Annual Report, p. 33.

[10]Federal Register. Dep. of the Treasury (Office of Foreign Assessment). Change to the List of Specially Designated Nationals of Cuba. V.60, No. 122, June 26, 1995, pp. 33029-33030.

[11]Mining Journal, London. Odd Man Out. V. 321, No. 8333, June 30, 1995, p. 485.

[12]Northern Miner. Northern Orion Firms Up Property Holdings in Cuba and Argentina. V. 81, No. 48, Jan. 29, 1996, p. 1.

[13]Metals & Minerals Latin America. Northern Orion Close to Cuban Mine Decision. V.1, No. 6, Jan. 24, 1996, pp.1,8.

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TABLE 1
CUBA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Cement, hydraulic		2,000,000	2,000,000	1,048,600 r/ 3/	1,081,100 r/ 3/	1,200,000
Chromite		50,000	50,000	50,000	50,000	50,000
Cobalt 4/		1,328 r/	1,357 r/	1,255 r/	1,139 r/	1,780
Copper, mine output, Cu content		2,000	1,500	1,500	1,400	1,500
Gas, natural:						
Gross	thousand cubic meters	34,000	36,000	36,000	37,000	37,000
Marketed	do.	4,000	4,000	4,000	4,000	4,000
Gypsum	thousand tons	130	125	125	125	130
Iron and steel, steel, crude	do.	180 3/	134 3/	91 r/ 3/	131 r/	207 3/
Lime	do.	180	160	180	170	180
Nickel:						
Mine output, Ni-Co content of oxide and sulfide		33,349 3/	32,190 3/	30,227 3/	26,926 3/	41,000
Metallurgical products, Ni content: 4/						
Granular oxide, oxide sinter, and powder		18,531 r/	16,717 r/	15,999 r/	13,930 r/	18,500
Sulfide		13,490 r/	14,116 r/	12,973 r/	11,857 r/	20,652 3/
Total		32,021 r/	30,833 r/	28,972 r/	25,787 r/	39,152
Nitrogen, N content of anhydrous ammonia	thousand tons	140	135	135	130	135
Petroleum:						
Crude	thousand 42-gallon barrels	5,150	5,870	7,320	9,320	10,200
Refinery products	do.	53,000	55,000	55,000	55,500	60,000
Salt	thousand tons	200	185	185	175	180
Silica (industrial sand and gravel)	do.	500	450	400	300	300
Sulfur, byproduct of petroleum	do.	4	5	5	4	5

e/ Estimated. r/ Revised.

1/ Table includes data available through Apr. 16, 1996.

2/ In addition to commodities listed, crude construction materials (marble, sand and gravel, stone, etc.) may also be produced. But data on such production are not available, and information is inadequate to make reliable estimates of output levels.

3/ Reported figure.

4/ Anuario Estadístico de Cuba provides figures of nickel-cobalt content of granular and powder oxide, oxide sinter, and sulfide production. Using an average cobalt content in these products of 0.9% in total granular and powder oxide, 1.1% in total oxide sinter, and 4.5% in total sulfide, the cobalt content of reported Ni-Co production was determined to be 1.16% of granular and powder oxide, 1.21% of oxide sinter, and 7.56% of sulfide. The remainder of reported figures would represent the nickel content.

TABLE 2
CUBA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Empresa del Cemento (Government, 100%)	Mariel, Pinar del Río Province; Cienfuegos, Ciengfuegos Province	3,500
Chromite	Ministerio de Industria (Government, 100%)	Mercedita Mine and plant, Holguín Province	60
Copper	Empresa Minera de Occidente (Government, 100%)	Mantúa, Matahambre, and Jucrad Mines, Pinar del Río Province Mina Grande, Santiago de Cuba Province	3
Nickel	Metals Enterprise (Government, 50%, Sherritt International Corporation, 50%)	Punta Gorda, Holguín Province	30
Do.	Empresa Niquelífera Comandante Pedro Soto Alba (Government, 100%)	Moa, Holguín Province	24
Do.	Empresa Niquelífera Comandante Rene Ramos Latour (Government, 100%)	Nicaro, Holguín Province	30
Petroleum:			
Crude	Empresa de Perforación y Extracción de Petróleo (Government, 100%)	Northern coast area between Havana and Cárdenas	12,000 1/
Refinery products	Instituto Cubano del Petróleo (Government, 100%)	Refineries at Cienfuegos, Havana, and Santiago de Cuba	160 1/
Steel	Antillana de Acero (Acinox, 100%)	Cotorro, Havana Province	600
Do.	Acinox (Government, 100%)	Las Tunas, Las Tunas Province	150

1/ Thousand barrels per year.

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THE MINERAL INDUSTRY OF

THE DOMINICAN REPUBLIC

By Ivette E. Torres

The economy of the Dominican Republic grew by 4.8% in real terms in 1995 according to the Central Bank. But inflation was 9.2%, an improvement from that of 1994 when inflation exceeded 14%. The economic growth was stimulated mainly by the communications, tourism, minerals, commerce, transport, and construction sectors. According to the Central Bank, in terms of value, the minerals sector increased by more than 9%.[1]

During the year, a new law to attract foreign investment was being considered by the Government. The law, which would replace the 1978 Foreign Investment Law (Law No. 861) as modified in 1983 by Law No. 138, was passed by the Chamber of Deputies early in the year and was sent to the Senate in September. The law was designed to remove differences between the rights of local and foreign investors by removing restrictions of foreign investment that apply to certain sectors, although foreign investment restrictions would be maintained in some areas such as the production of material or equipment related to national security and defense, public services, agriculture, banking, and insurance.[2] The new law would allow foreign investors to repatriate their profits. The law had not been approved by yearend, but was expected to pass early in 1996.

In 1995, the size of mineral industry of the Dominican Republic continued to be modest by world standards, but very significant to the country's domestic economy. The country produced cement, gold, gypsum, limestone, nickel, salt, and silver. Other construction materials were produced for domestic consumption. The Dominican Republic imported all of its domestic requirements of crude petroleum.

The Government of the Dominican Republic was actively involved in the production of mineral commodities. Rosario Dominicana S.A., the only gold and silver producer in the country, was owned by the Government. The Government holding company, Corporación Dominicana de Empresas Estatales (CORDE) owned or held a minority interest in the production of gypsum, marble, nickel, and salt. CORDE's cement producer Fábrica Dominicana de Cemento was inactive in 1995. During the year, the Government was considering the sale of many of CORDE's companies, including the Fábrica Dominicana de Cemento, but no final decision was made by yearend.

By far, the United States was the Dominican Republic's main trading partner. Canada and Latin America were also important trading partners.

Production of gold in 1995 from Rosario Dominicana S.A.'s Pueblo Viejo mine increased almost fivefold from that of 1994 to 3,288 kilograms after 2 years of extremely low production following the mine's closure at the end of 1992. The mine reopened in late 1994.

During the last several decades, the Dominican Republic has been an important world producer of nickel in the form of ferronickel. Ferronickel has been very important to the Dominican economy and a stable source of earnings and Government revenues. In 1995, Falcondo produced 30, 897 metric tons of nickel in ferronickel. Of that, 30,659 tons was exported, all to Canada where the company's ferronickel was purchased and marketed by Falconbridge Ltd., the company's majority shareholder. In 1995, Falcondo paid a total of $56 million in taxes to the Government of the Dominican Republic. The company's earnings after taxes totaled $55.6 million, a 39% increase from that of 1994. The large increase was due mainly to the improvement in nickel price during the year.

According to Falcondo's company annual report, the ore reserves in 1995 were 31.1 million tons grading 1.72% nickel. During the year, the company constructed a pilot plant to test parameters for an improved commercial laterite upgrading circuit. Testing, which began at yearend, was expected to be conducted for 6 months. Depending on the outcome of the testing, if successful, the company could bring the circuit into operation before yearend 1997, increasing the production level by 5,000 tons of nickel in ferronickel, as well as decreasing operation costs and extending the life of the ore bodies.

The Dominican Republic imported 12 million barrels of crude petroleum in 1995. Most of the crude was imported from Mexico (48%) and Venezuela (51%) under the 1980 San José Accord. Under the accord, the Dominican Republic is guaranteed 26,000 barrels per day of crude petroleum for internal consumption, although the country is not restricted from purchasing crude from other sources.[3] Colombian Vasconia supplied the remaining 1% imported in 1995, which was imported to evaluate the company's processing of this relatively new crude in the

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market.[4] The Refinería Dominicana de Petróleo S.A. (REFIDOMSA) in Haina, Distrito Nacional, produced 11.66 million barrels of petroleum refinery products in 1995. REFIDOMSA has monopoly rights to imports, but distributors and some private companies are allowed to import unleaded gasoline.

REFIDOMSA's production capacity meets about one-third of the Dominican Republic's demand for fuel. Falconbridge Dominicana C. por A. (Falcondo) also owned a petroleum refinery in La Peguera, which supplied electricity to its ferronickel plant and it sold its excess electricity to the Dominican electric company, the Corporación Dominicana de Electricidad. In addition, the Dominican Republic meets the remainder of the demand by importing refinery products. REFIDOMSA imported 13.7 million barrels of petroleum products during the year.

Petrolera Once Once S.A. (a Dominican-U.S.-Spanish consortium) and Mobil Exploration Dominicana Inc.-Murfin Dominicana Inc. were exploring for petroleum in the Dominican Republic.[5] Petrolera Once Once drilled a 1,830-meter hole and a 1,220-meter hole in its Cibao Basin, 2.5-million-acre (about 10,000 square kilometers) concession in 1995 and was expected to drill two more in 1996. The 1995 drillings did not result in output levels for commercial production.

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[1]James, C. Journal of Commerce. Dominican Economy Continues to Expand. V. 407, No. 28,659, Feb. 12, 1996, p. 3A.

[2]World Trade Organization. Trade Policy Review Dominican Republic. Report by the Secretariat. WT/TPR/S/11, Jan. 3, 1996, 116 pp. (Check Restriction)

[3]Work cited on footnote 2.

[4]Artillez, R. and M. Osorio. El Suministro de Hidrocarburos en el 1995. La Caldera, Refinería Dominicana de Petróleo S.A. No. 49, pp. 2-3.

[5]Ellis, G. M. Two Basins Explored in Dominican Republic. Oil and Gas Journal. V. 94, No. 18, Apr. 29, 1996, p. 71.

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TABLE 1
DOMINICAN REPUBLIC: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
Aluminum, bauxite, dry equivalent, gross we	thousand tons	7	–	–	–	–
Cement, hydraulic	do.	1,235 r/	1,365	1,271 r/	1,276 r/	1,453 3/
Coal, subbituminous e/		600	600	600	600	600
Gold	kilograms	3,082 r/	3,813 r/	366 r/	595 r/	3,288 3/
Gypsum	thousand tons	118	83	85 e/	83 e/	85
Iron and steel:						
Ferroalloys, ferronickel		74,813 r/	71,417 r/	60,774 r/	79,000 r/ e/	79,000
Steel, crude		39,299 r/	32,628 r/	–	–	–
Limestone		449,000	589,000	500,000 e/	550,000 e/	550,000
Nickel:						
Mine output, Ni content		44,661 r/	42,641 r/	37,423 r/	48,000 r/ e/	48,000
Metal:						
Smelter, Ni content of ferronickel		29,063	27,530	23,900	30,776 r/	30,897 3/
Shipments, Ni content of ferronickel		28,029	27,214	25,614	31,387 r/	30,645 3/
Petroleum refinery products: e/						
Liquefied petroleum gas	thousand 42-gallon barrels	318 3/	320	315	320	350 3/
Gasoline, motor	do.	2,350 3/	2,350	2,300	2,350	2,099 3/
Kerosene and jet fuel	do.	1,140 3/	1,150	1,150	1,150	1,865 3/
Distillate fuel oil	do.	2,760 3/	2,800	2,800	2,850	2,682 3/
Residual fuel oil	do.	3,730 3/	3,750	3,800	3,850	4,664 3/
Total	do.	10,298 3/	10,370	10,365	10,520	11,660 3/
Salt e/ 4/		11,400	12,000	11,500	10,000	10,000
Sand	thousand tons	4,880	5,130	5,000 e/	5,500 e/	5,500
Silver	kilograms	21,955	14,972	1,000 r/ e/	2,300 r/ e/	21,066 3/

e/ Estimated. r/ Revised.
1/ Table includes data available through Oct. 31, 1996.
2/ In addition to commodities listed, crude construction materials (gravel, stone, etc.) may also be produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.
3/ Reported figure.
4/ Rock salt only.

TABLE 2
DOMINICAN REPUBLIC: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Fábrica Dominicana de Cemento C. por A. (Government, 78%; private, 22%)	Santo Domingo, Distrito Nacional	700
Do.		Cementos Cibao C. por A. (private, 100%)	Santiago Province	400
Do.		Cementos Nacionales S.A. (private, 100%) (Private, 100%)	San Pedro de Macorís, San Pedro de Macorís Province	650
Doré (gold and silver)	kilograms	Rosario Dominicana S.A. (Government, 100%)	Pueblo Viejo Mine, Cotui, Sánchez Ramírez Province	56,700
Gypsum		Loma de Sal y Yeso C. por A. (Government, 100%)	Barahona Province	200
Nickel		Falconbridge Dominicana C. por A (Government, 10%; Falconbridge Ltd., 86%; Redstone Resources, Ltd., 4%)	Mine and plant at Bonao, La Vega Province	35
Petroleum products		Refinería Dominicana de Petróleo S.A. (Government, 50%; Shell Oil Co., 50%)	Haina, Distrito Nacional	12,000 1/
Do.		Falconbridge Dominicana C. por A. (Government, 10%; Falconbridge Ltd., 90%)	La Peguera, La Vega Province	1,000 1/
Salt		Loma de Sal y Yeso C. por A. (Government, 100%)	Barahona Province	20
Steel		Metaldom (Government, 100%)	Santo Domingo, Distrito Nacional	100

1/ Thousand 42-gallon barrels.

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THE MINERAL INDUSTRY OF

ECUADOR

By Pablo Velasco

The mineral industry of Ecuador in 1995 continued to be dominated by the petroleum sector, which contributed 36% of the country's's total export revenues and accounted for nearly 12% of the GDP. According to statistics released by the Ecuadorian Central Bank in 1995, the value of crude oil and refined products was about $1.5 million.[1] Although mining was considered unimportant, the Government was committed to transforming this sector into an important contributor to the country's economic development. Progress so far has been limited. However, given the country's mineral potential, the implementation of new mining policies, and the number of foreign mining companies already exploring in the country, this sector could become economically important in the near future.

Metal mining was oriented toward gold. Nonmetallic mining was oriented toward cement and industrial minerals, contributing less than 1% of the country's GDP and export revenues. In 1995, the gross value of mineral production-mainly industrial minerals-was about $120 million.

The mining industry which is currently oriented toward gold, is still small in size and largely informal and unregulated. About 40,000 miners involved in artisanal gold production use primitive mining and processing techniques, including mercury for amalgamation, recovering about 30% to 50% of the gold. Mercury amalgamation creates health hazards in the mining Districts near Nambija, Portovello-Zaruma, and Ponce Enriquez Districts and pollutes nearby rivers in southern Ecuador. Collectively, these small freelance miners accounted for most of value of Ecuador's gold production, smuggling most of it out of the country.

The Ecuadorian economy grew by 3.0% in real terms during 1995, led by trade, manufacturing, foodstuffs, and mineral production. The inflation rate declined to about 23%, compared with 25.4% in 1994.

Government Policies and Programs

The apparently endless chain of crises in 1995-war with Perú, power cuts, and measures to overcome existing economic problems to create a favorable and positive environment to attract both domestic and foreign investments-has taken a toll on the economy. A reduction in inflow of short-term capital and a weak currency discouraged investors. On December 20, Congress agreed to the country's membership in the World Trade Organization (WTO). Under WTO rules, Ecuador became a full member on January 20, 1996. Government officials hoped that membership in the WTO would attract foreign investment and stimulate exports. During a recent summit of South American countries in Quito, Ecuador, Andean Pact members Ecuador, Colombia, Perú, Bolivia, and Venezuela announced initiatives to transform the Andean Pact into an organization that encourages greater trade and integration. Ecuador and Colombia signed a bilateral trade agreement. The Government of Ecuador extended to 24 private banks the right to administer Ecuador's import/export licensing programs in order to reduce bureaucratic red tape on trade. Traders can choose the bank that offers the best service at the lowest cost. According to the Constitution, all subsurface resources are property of the state. Petroleum is the basis for Ecuador's external economy, with average daily production approaching 400,000 barrels per day (bbl/d) of crude oil in 1995. In June, the Government announced an eighth round of bidding for nine blocks in the Amazonian Oriente. Oil producers in the Oriente rely on the Trans-Ecuadorian oil pipeline, with a capacity of 325,000 bbl/d, to move crude to the Esmeralda's oil refinery. Because of the capacity limits of the pipeline, the volume of crude evacuation by private contractors is being rationed and export volume will not increase this year. The Government was in the process of awarding a $600 million build-operate-transfer concession to expand pipeline capacity to 450,000 bbl/d.

Ecuadorian mining policy is undergoing fundamental changes, based on presidential decrees. These changes include,(l) reforms to mining laws and regulations, (2) guarantees and security for mining investment,(3) organization and technical support for artisanal mining activities,(4) restructuring and strengthening of the state mining institutions, and (5) a national mining plan. By mid-1995, the administration had decided to postpone reforms to the mining law and regulations because of an unfavorable political situation in the National Congress.

National bank of promotion, Banco Nacional de Fomento (BNF), officials announced that the bank had suspended its privatization schedule for Chimborazo Cement Co. set for Sept. 20, because of the limited time to meet all of the legal requirements set by the Government. BNF owns 95.2 % of the company's shares, the remainder is owned by National Financing Corp. 4 foreign companies from (Chile,

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Colombia, Spain, and Mexico), along with several Ecuadorian firms, have expressed interest in the sale. Ecuador will pay about $225 million in interest in 1995 under a debt-restructuring agreement with private banks. Under the agreement, Ecuador will receive a 45% discount on capital debt, which will reduce the Nation's debt from $4.471 billion to $2.460 billion over a 30 years period.

Environmental Issues

A loan agreement with the World Bank was completed in June 1994 for a Mining Development and Environmental Control Technical Assistance Project. Financing provided by the World Bank to the Ecuadorian Government, will be $14 million and $1.9 million respectively. Cofinancing by the Swedish Government's Agency for International Technical and Economic Cooperation (BITS) and the Overseas Development Agency, UK (ODA), with $5.1 million and $3 million respectively, will complement the project, for a total of $24 million over a 5-year period.

The Ministry of Energy and Mines (MEM) through its Subsecretariat of Mining, and the National Directorate of Mining (DINAMI), National Directorate of Environment (DINAMA), Corporation for Geological-Mining-Metallurgical Research and Development (CODIGEM), administered, coordinated and enforced the new environmental laws and regulations on behalf of the ministry. Environmental concerns are the major focus of a mining project design. While industrial-scale mining must undertake strict environmental control measures, the primitive methods used by small miners escape such controls and are leading to serious environmental degradation. Most of the gold mining occurs in the El Oro, Azuay, and Zamora-Chinchipe Provinces, including six major mining sites, three of which have been mined for long periods of time--Portovelo-Zaruma, Nambija, and Ponce Enriquez--and have created the greatest environmental damage and threats.

Erosion is being caused by the cutting of forests and the opening of mine shafts in mountain slopes. Mining communities involving over 40,000 people, may be affected by mining-related health problems, such as mercury poisoning. The intensive use of mercury by miners and its subsequent discharge are serious problems. The ratio of mercury use to gold production is as high as one to one. Discharge of mercury and heavy metals--including cadmium, copper, lead, and zinc,--into the nearby river systems appears to be affecting downstream fishing activities and drinking water sources.

The Government has included an environmental component in the seventh and eighth rounds of oil and natural gas concessions, and has invited environmental consulting firms to apply for approval to conduct environmental studies for the seventh and eight rounds of concessions. The studies will include initial inventories of the concession areas and subsequent exploration and exploitation studies. Additional opportunities for environmental firms are expected once the Government and Texaco reach agreement on environmental cleanup efforts in the Oriente.

Production

According to the Constitution, all subsurface resources are the property of the state. Petroleum was the basis for Ecuador's external economy, with production in 1995 accounting for 12% of GDP, 36% of export earnings, and 30% of public sector revenues. Total crude production for 1995 was 143 million barrels (bbl), up 3.6% compared with that of 1994. Ecuador has extensive, but underdeveloped, deposits of gold and other minerals. In 1995, gold production increased to more than 15 tons valued at more than $200 million, of which 80% was produced by artisanal mining concentrated in the mining-districts of Nambija, Zaruma- Portovelo, Ponce Enriquez, and other areas in the south. The mining sector's primary output was industrial minerals, which, with the exception of some pumice stone and marble, were consumed by the domestic construction industry.

Trade

Despite of ongoing problems with European Union import restrictions, total exports increased 12.5% in value to $4.3 billion in 1995 and oil and derivatives increased 17.2% to $1.5 billion when compared with 1994. Imports jumped 23.2% to $4 billion because of increased spending on fuels and military hardware. The price of Ecuadorian light crude oil increased from an average of $13.68 per barrel in 1994 to over $16.00 in 1995. Increased sales to members of the Andean Pact and other countries worldwide accounted for much of the increase in nonpetroleum exports.

The United States continued as Ecuador's principal trading partner. During 1995, the value of exports to the United States increased 10%, reaching $1.6 billion. Crude oil and processed petroleum exports to the United States were valued at $416.1 million. Imports from the United States, primarily machinery, increased slightly to $1.2 billion in 1995.

The diversification of Ecuador's markets was reflected in export growth of 41% to the European Union and 35% to Colombia and Peru in 1994. Ecuador has free trade agreements with Chile, Colombia, and Venezuela.

Structure of the Mineral Industry

The Ecuadorian Government regulated the mineral industry through the MEM Subsecretaria de Minas, which administered the mineral industry through its three

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agencies: CODIGEM, DINAMA, and DINAMI.

CODIGEM, the Corporation for Geological, Mining and Metallurgical Research and Development, was responsible for development and maintenance of geologic, mapping, and mining data bases. CODIGEM also provided technical assistance to miners, in addition to supporting mining, geology, metallurgy, and seismic research. DINAMA, the National Environmental Directorate, was concerned with environmental aspects of resource development. DINAMI, the National Mining Directorate, granted mineral concessions and appropriate exploration and exploitation permits. Petroecuador, the state-owned petroleum holding corporation, reorganized in 1992, and its subsidiaries produced, refined, stored, transported, and sold crude oil and petroleum products. Petroecuador's operating subsidiaries, Petroamazonas and Petroproducción, were combined to form Petroproducción .

International petroleum companies produced crude oil and natural gas under contract with the Government and were involved in downstream trade. According to the 1995 membership list of the Ecuadorian Chamber of Mines, more than 150 small mining companies and cooperatives operated in the country. Additionally, more than 40,000 small-scale and informal artisanal miners were active, primarily in the gold sector. Much of the Nation's gold output was being produced by these small, commonly illegal, operations. Informal miners either worked individually or in small groups. Cooperatives were formed, principally because they could obtain legal rights to the mining operation. Cooperatives were concentrated in the south in the El Oro, Azuay, and Zamora-Chinchipe Provinces, particularly around the areas of Nambija, Zaruma-Portovelo, and Ponce Enriquez.

More than 200 gold production plants used gravitational, amalgamation, cyanide-based, and some floatation techniques in the country in 1995. The total ore treating capacity was about 2,500 t/d. About 400 registrations for artisanal miners and about 1,800 applications tor exploration covering 6.6 million hectares (ha) were filed, demonstrating an increasing interest in exploration. Indeed, the presence of major multinational mining companies, including Newmont Overseas Explorations Ltd. (Newmont), of the United States; Gold Fields of South Africa Ltd.; RTZ Corp. Plc, of the United Kingdom; Gencor of South Africa; Cogema of France; Odin Mining Co. of the United States; Echo Bay Mines Ltd. of Canada; Teck Corp. of Canada; TVX Gold Inc. of Canada; Ag Armeno Mines and Minerals of Canada; F.M.C. Corp. of the United States; Río Amarillo Mining Ltd. of Canada; Battle Mountain Gold Corp. of the United States; Canyon Resources Corp. of Canada; Zamora Gold Corp. of Canada; Ecuadorian Minerals Corp. of Canada; Cominco Resources International Ltd. of Canada; Northfield Minerals Inc. of Canada; Latin American Gold Field Ltd. of Argentina; Granges Inc. of Canada; Jersey Goldfields Corp. of Canada; Zappa Resources Ltd. of Canada and Cambior of Canada, indicated a very promising mining outlook for Ecuador.

Commodity Review

Metals

Copper.—Toronto, Canada-based junior Ecuadorian Minerals Corp. (EMC), has negotiated an option to acquire up to 65% interest in the Chaucha property held jointly by Ag Armeno Mines and Minerals Inc. and Ecuadorian Copperfields Inc. (ECI). The property comprises 5,100 ha in two exploration concessions and is located in the Chaucha copper-gold property that lies southeast of Guayaquil in Ecuador, approximately 32 km northeast of Ecuadorian's wholly owned Gaby gold deposit. Several areas of gold mineralization have recently been identified by Armeno/ECI from stream sediment sampling programs. Follow-up soil sampling in the Naranjos copper zone included gold values ranging up to 6 g/t gold. Under the terms of the letter of intent, EMC will be the operator and acquire an initial 55% interest in the property over a 4 year period, by paying Armeno/ECI $505,000 in cash, by issuing 250,000 common shares of EMC, and by incurring $3 million in exploration expenditures. EMC can increase its interest in the property to 65 % by issuing another 200,000 shares and by paying Armeno/ECI $1.5 million within 180 days of earning the initial 55% interest. In the 1970's and 1980's, Japanese and Belgian interests drilled out 130 million to 140 Mmt of geological resources grading 0.39% to 0.41% copper. About 12,300 m of core were drilled, but to date none has been analyzed for gold.

Newmont reported earning a 60% interest in the Fierro Urco copper-gold property, jointly owned by Ag Armeno and Trans Atlantic Enterprises Inc. of Canada. Ag Armeno operated the underground San Bartolome silver mine. Ag Armeno also owned the large Peggy copper-gold property, optioned to Curlew Lake Resources Inc. of Canada, which could acquire 50% interest of the property, and the Chaucha copper-molybdenum property. RTZ suspended work at the San Jose de Salinas prospect and has focused on two other copper-gold prospects: El Pueblo and La Victoria, both in the Western Cordillera. RTZ has found interesting results at the El Corazón property in northwestern Ecuador. A possible epithermal gold and silver mineralization .

Gold.—Small-scale, intermittently producing gold-mining operations were spread throughout the country. Unofficial reports indicated that Ecuadorian gold production totaled approximately 15.5 t/yr. Ore was extracted from diggings and processed in small gravitational, amalgamation, and cyanide-based plants. The primitive ore treatment plants only recovered between 30% to 50% of the gold.

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Alluvial gold operations also were numerous. The Australian company, Odin Mining & Investing Co. Ltd., reportedly was the largest formal gold producer in the country, recovering more than 600 kg of gold from its placer operations, the Biron Mine, and the Río Chico Mine.

EMC, reported that drilling had resumed in November 1995 at its Gaby gold property in Ecuador. EMC recently announced an expanded gold resource estimate of 108,862 kg on the main Gaby deposit. The drilling program was expected to be completed in April 1996, forming part of the prefeasibility study that was scheduled to be completed by summer 1996. This study would provide a preliminary evaluation for the Gaby deposit to start production, including an assessment of tonnage, grades, optimal process flow-sheet, and capital and operating costs. Funding for this drilling program was being provided by the exercise of share purchase warrants from previous private placement. To date, about $1.1 million has been received and an additional $3 million was expected before yearend.

Canada's TVX Gold Corp. has approved the development of the Pachicutza gold mine in Ecuador, following completion of a successful exploration program. The company has conducted some 21,400 m of drilling and 8,100 m of drifting on the high-grade zone of Pachicutza to delineate close to I million ton of proven, probable, and possible reserves assaying some 12 to 13 g/t of gold. Zamora Gold Corp. continues exploring its 90,000-ha land package in the Province of Zamora Chinchipe. The package includes blocks surrounding Nambija. Initial work has focused on the Mina Real concession, adjacent to Nambija's artisan workings. The concession's geologic setting was described by the company as a large porphyry-skarn system, with a later epithermal gold overprint at the Tumi d'Oro Zone. Zamora estimates the total length may extend beyond I km. The first phase of drilling tested 250 m of strike length in the northwestern extension of the zone. A further seven holes are planned at the Mina Real concession. Four holes will test the Tumi d'Oro structure, while three will test the Guaysimi Sur Breccia target. Northfield Minerals will acquire its second gold property in Ecuador. The company has signed an agreement to gain a 65 % interest in the Nambija Uno mining concession, which comprises 627 ha in the Zamora-Chinchipe Province. Previous work by Goldfields of South Africa and Northfield's joint-venture partner, Compañía Minera Gribipe, outlined four major targets. The most advanced of these is the Diamante, in the northeastern sector of the concession. Based on the work done, Gribipe estimates the target may contain a resource of more than 124,414 kg of gold. To earn the 65% interest Northfield must pay $6.5 million to Gribipe and the mining cooperative over S ½ years. It must also issue to Gribipe 1 million common shares of Northfield and options to buy another 1 million shares.

Since its rediscovery in 1980, Nambija, an ancient Inca mine site, has been Ecuador's principal gold mining center. Approximately 2,000 to 3,000 informal miners worked the area. Although this unstructured, unregulated, and untaxed mining activity relieved unemployment, it had serious environmental and social drawbacks. The denuded mountainside was honeycombed by a profusion of ditches and tunnels (some to a depth of 300 m), which severely undermined the ground beneath the mining areas and the town. Government safety intervention could put thousands of informal miners out of work. In 1993, a landslide destroyed part of Nambija and buried an estimated 300 people. Concerned that the rest of the town would cave in, the Government requested that all mining activity cease. The Government also recommended that the miners move 8 km away to a safer area. The miners rejected the request, remained on location, and continued to mine, claiming the need to defend continuously their small pits and shallow tunnels from claim jumpers. Miners also accused the Government of selling out their interest to foreign mining companies.

Gold Fields of South Africa Ltd. entered a joint venture on a cooperative's concession in the Nambija area. With the cooperative's consent, Gold Fields started exploration, but local citizens blocked access to the area, because they were afraid that the international firms would swallow all of the region's operations, instead of working only on its concession area. TVX Gold Inc. has entered into a contract with the Ecuadorian Army's Industry Division (DINE), to explore the Pachicutza gold property. Pachicutza lies approximately 60 km southeast of Loja
and consists of three claim blocks totaling 120 square km. Prior work by other companies has identified major gold-bearing structures and outlined an open-pit mine resource of several million tons of ore grading 2 to 3 g/t of gold. A detailed drilling program was planned.

Industrial Minerals

Similar to metallic mine potential the economic potential of industrial minerals was being investigated and considered as a way to satisfy the National demand for building materials, thus saving importation expenditures. Of great importance, because of their volume, are the limestone deposits found in 15 provinces of Ecuador, which supply the raw material for the four main cement factories in the country. In the south, an important ceramic industry was using considerable kaolin and feldspar reserves. In the east, the country has great extensions of siliceous sands in the Sub-Andean Zone. Actually, important deposits are being mined to supply small glass bottle factories, ceramic and Ph (degree of acidity or of basicity of a solution) correctors of the limestone for the production of cement. Gypsum's production is concentrated

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in the southern part of the country, in the Loja Province. Exploitation of pumice stone has become an important activity, especially in the central provinces of the highlands. For years, this raw material has been exported to countries of Latin America, the United States and Eastern Asia. Technical economic support are required to transform this resource into a large-scale operation. Construction materials are available in all provinces, representing 90% of the industrial materials needed in the country. The most significant industrial mineral operations were the cement and cement-related industries involving limestone and clays. Other industrial mineral operations included the marble quarries of Industria Marmolera Ecuatoriana S.A., Mármoles Andinos Cía. Ltda., Mármoles Santa Rosa Cía. Ltda., and Marmolera Chimborazo; the calcium carbonate operations of Cecál S.A.; Charasól's bentonite mines; and the barite pit of Mineral Bomboiza.

Mineral Fuels

Since Ecuador left the Organization of Petroleum Exporting Countries in January 1993, oil production had been increasing sharply by 6% to 365,000 bbl/d in 1994 and by another 7%, to 390,000 bbl/d, in 1995. The country also continued to increase its reserves. By yearend 1994, reserves were 2 billion barrels, or about 43% more than in 1990. Despite an environmental damage suit brought against Texaco by Ecuadorian Indian organizations and the threat of another suit by the Government, a fairly good response was received to the seventh bidding round that concluded in June 1994, a keystone in the Government's effort to increase reserves to 4.2 billion barrels by the end of this decade. Bids were received from 21 companies for 8 of the 13 blocks being offered. The first awards were announced in June. Still pending in mid-1995 was a decision on the $600 million expansion of pipeline capacity, offered to private investors under a 15-year contract. The Trans-Ecuadorian pipeline was a main bottleneck, transporting 325,000 bbl/d of the country's 390,000 bbl/d output. Another 30,000 bbl/d flowed through the Trans-Andean pipeline via Colombia. The Government planned to expand the main crude oil line of 463 km by adding another section totaling 172 km, increasing total capacity to 400,000 bbl/d. Some 20 foreign companies were reportedly interested in the venture.

Reserves

Ore reserves of both metallic and industrial minerals were small in world terms but considered significant in Latin America. Ecuador was believed to have significant undelineated gold resources, as gold mining essentially stopped during the colonial era (16th and 17th centuries).

Ecuador produced crude oil, mostly from fields in the Amazon basin operated by Petroecuador, the State oil company. Of the remaining proven reserves of 21 billion barrels, 3.5 billion barrels could be extracted using current methods and 11.8 billion barrels could be extracted using advanced technology. The country's proven crude oil reserves should last well into the next century at the present rate of production.

Infrastructure

Ecuador's infrastructure was cited by Government officials as a factor in restricting mineral sector development. Mine production was transported by truck on the Nation's 43,709 km of highways or by the 965 km of state-operated rail to processing plants and shipping ports.

Petrocommercial, a subsidiary of Petroecuador, was responsible for the transportation of oil. Crude oil was transported from the oilfields in the Oriente region through the Ecuadorian Transandean oil pipeline system via Quito to Esmeraldas or Guayaquil tor export or processing and domestic distribution. This pipeline repeatedly exceeded design capacity during the year. Additional production was shunted through the Transandean pipeline in southern Colombia to the export terminal at Tumaco. A new 150,000-bbl/d capacity pipeline, parallel to the existing Ecuadorian pipeline, from Lago Agrio to Esmeraldas was proposed. Maxus Energy Corporation of Dallas, Texas, also had 352 km of product pipeline under construction in the east.

Outlook

The mining sector, especially gold, silver, and base metals, could supplement petroleum as an important source of national income. However, significant foreign investment would be needed to create adequate infrastructure and the Government would need to boost investor confidence by maintaining and improving the fiscal and legal environment for mineral exploration and development.

Measures implemented by the current administration under the Ministry of Energy and Mines are being viewed with much optimism. New mining policies could stabilize the National economy and provide the right atmosphere for foreign investment. The optimism was temporarily shaken by the recent border dispute with Perú, although Ecuador has largely regained the trust of the international financial community. The process of modernization and privatization of inefficient government institutions and industries has continued, seeking to reduce public spending, holding down inflation and building a more vigorous national economy. Ecuador, which has long ignored its potential as a minerals producer, could be the site of important investments in the medium term. However, interest in gold projects, with their associated quicker return on

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investment, should dominate the short-term horizon. Junior and major multinational companies already have begun intensive exploration programs. A moderate increase in poly-metallic mining is also envisioned, together with strong development of industrial-minerals mining and an increased level of industrialization. The mining activities envisioned for the year 2000 are no longer traditional nor will they use obsolete technologies. Foreign investment, together with state policies and strategies, and the support of the World Bank will no doubt achieve the development of mining projects in Ecuador, by means of a modern, mechanized mining industry.

Upgrading the recovery rate and discharge and emissions from primitive gold recovery operations also must be addressed. Environmental awareness and activism should become more entwined with natural resources development in Ecuador.

Petroecuador was expected to expand its production and transport capacity, most notably the construction of a liquified petroleum gas terminal and petroleum product pipelines. However, Petroecuador's mandated domestic sale of refined products at steeply subsidized prices was expected to continue to encourage product smuggling and eventually enervate Petroecuador's competitive stance.

The Government and the private sector oil executives disagreed about the prospects for the expansion of the Transecuadorian oil pipeline. Government officials insisted the president was committed to the pipeline expansion project and would shortly award the contract. The private sector oil executives agreed the president supported the project, but maintained his administration lacked the political will and strength to face down opposition to the project within the Ecuadorian military and labor unions.

With the recent departure of the Vice President, the project's most influential advocate, the administration's ability to keep the project on track may have weakened.

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[1]Where necessary, values have been converted from Ecuadorian sucres (S/) U.S.dollars at the rate of S/2.930 = US$1.00.

Major Source of Information

Ministerio de Energía y Minas
Subsecretaría de Minas
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Quito, Ecuador
Telephone: 593-2-570-376
Facsimile: 593-2-570-350
Corporación de Desarrollo e Inversión Geológico-Minero Metalúrgica (CODIGEM)
Casilla 17-03-23, Av. 10 de Agosto 5540 y Villalengua
Quito, Ecuador
Telephone: 593-2-240-209
Facsimile: 593-2-463-861
Cámara de Minería del Ecuador
Ave. Rep. del Salvador #525
Edif. Rosania, Ofic. 14
Quito, Ecuador

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Banco Central del Ecuador-Division Tecnica; BoletinAnuario.
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TABLE 1
ECUADOR: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
METALS						
Cadmium: Mine output, Cd content e/	kilograms	200	260	260	250	200
Copper: Mine output, Cu content e/		100	100	100	100	100
Gold: Mine output, Au content	kilograms	12,200	12,300 r/	12,500 r/	13,000 r/ 3/	15,500
Iron and steel:						
Steel, crude		20,500	20,000 e/	26,600	21,800	21,400
Semimanufactures		202,000	19,000 e/	189,000	214,000	200,000
Lead concentrate, Pb content e/		200	200	200	200	200
Silver: Mine output, Ag content e/	kilograms	60	60	60	60	60
Zinc: Mine output, Zn content e/		50	35	33	100	100
INDUSTRIAL MINERALS						
Cement, hydraulic e/	thousand tons	2,300 e/	2,250 e/	2,098 r/	2,164 r/ 3/	2,300
Clays:						
Bentonite		135	393	350	300	300
Common:						
For cement	thousand tons	3,660	3,100	1,820 r/	2,000	2,000
Other		283,000	278,000	267,479 r/	42,099 r/ 3/	350,000
Kaolin		12,000	6,380	12,000 r/	6,883 r/ 3/	6,000
Feldspar		2,254 r/	3,250	2,015 r/	2,200 r/	2,000
Sand:						
Silica (glass sand)		23,200	35,500	48,751 r/	33,535 r/ 3/	30,000
Ferruginous e/		23,200	15,000	10,000	10,000	10,000
Stone, sand and gravel:						
Limestone (for cement manufacture)	thousand tons	3,660	3,100	3,709 r/	6,229 r/ 3/	4,000
Marble		1,712 r/	1,960	8,620	9,500 r/ 3/	8,500
Pumice		33,500	20,600	12,230	8,665 r/ 3/	9,000
Sand and gravel	thousand tons	–	363	164	170	170
Sulfur: e/						
Native		4,000	4,000	4,000	4,000	4,000
Byproduct:						
From petroleum		5,000	5,000	5,000	5,000	5,000
From natural gas		5,000	5,000	5,000	5,000	5,000
Total		14,000	14,000	14,000	14,000	14,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	239	195	200 e/	200	200
Marketed e/	do.	90	90	90	90	90
Liquefied natural gasoline	thousand 42-gallon barrels	364	397	400 e/	400	400
Petroleum:						
Crude	do.	109,000	117,000	126,000	138,000 r/ 3/	143,000
Refinery products:						
Liquefied petroleum gas	do.	2,230	2,550	2,550 e/	2,550	2,600
Gasoline	do.	11,200	11,500	11,500 e/	11,500	11,700
Jet fuel	do.	1,420	1,530	1,500 e/	1,530	1,560
Kerosene	do.	1,140	786	800 e/	787	800
Distillate fuel oil	do.	10,300	10,500	10,500 e/	10,600	10,700
Lubricants	do.	208	256	260 e/	260	300
Residual fuel oil	do.	18,000	16,600	16,700 e/	16,600	16,900
Unspecified	do.	458	374	400 e/	374	400
Total	do.	44,900	44,200	44,200 e/	44,200	45,000

e/ Estimated. r/ Revised.

1/ Estimated data and totals are rounded to three significant digits; may not add to totals shown.

2/ Includes data available through May 1996.

3/ Reported figure.

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THE MINERAL INDUSTRY OF

EL SALVADOR

By David B. Doan

With an economy based largely on agrarian production and exports, El Salvador's mineral production accounted for less than 1% of its estimated gross domestic product (GDP) of $10 billion[1] in 1995. Approximately 40% of the labor force accounts for the 24% of GDP represented by the agricultural sector, which in turn contributes 66% of total exports, mainly coffee, sugarcane, and shrimp.

Although gold and silver have been mined in the past, civil strife and economic upheavel associated with hostilities between the Government and the Frente Farabundo Marti de Liberacion National (FMLN), a revolutionary movement, discouraged exploration and mining operations until after the 1992 peace agreement between FMLN and the Government. Investment and exploration have come back, as well as interest in reopening old mines. In roughly the northern one-half of this east-west oriented country, old Government maps (undated) indicate about a dozen gold-silver prospects, particularly in the eastermost Department of La Union, but also in Morazan and San Miguel Departments on the west side of La Union, evidently in epithermal quartz veins intersecting older volcanic rocks.

The venerable El Dorado Mine near San Isidro, about 50 kilometers (km) east-northeast of San Salvador, has been reinvestigated by Canada's Mirage Resources, with joint-venture partners Bethlehem Resources and DeJour Mines. Drilling results toward yearend projected a resource of 5.2 million tons (Mt) grading 6.29 grams per ton (g/t) of gold and 46 g/t of silver in three distinct vein systems.

Some mining activity and trade, by small local entrepeneurs, took place in the vicinity of the San Sebastian Mine near Santa Rosa de Lima, where mercury has been used for amalgamation recovery of gold from surrounding material. Despite efforts to foster gold production in El Salvador, cement dominated the mineral industry in terms of size, with domestic limestone production for its raw material, as shown in table 1. With an estimated capacity of about 925,000 metric tons per year (t/yr), the private sector controlled the industry. The Government sold the 240,000-t/yr Cemento Maya S.A. plant to Cemento de El Salvador S.A., which also operated a larger 640,000-t/yr plant near Metapan.

Another significant private-sector operation was the Refineria Petrolera Acajutla S.A, having a capacity of about 5.8 million barrels per year, owned by Exxon Corp. (60%) and Royal Dutch Shell (40%). Prices for both refinery products and portland cement were set by the Government.

El Salvador was the first Central American country to construct and utilize geothermal electric powerplants. The many volcanoes in the country suggest that other geothermal energy sources may be available.

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[1]Where necessary, values have been converted from El Salvador Colons (C) to U.S. dollars at the rate of C8.75=US$1.00.

Major Sources of Information

Direccion de Recursos Mineros
Ministerio de Economica
4a Avenida Norte No. 233
San Salvador, El Salvador

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TABLE 1
EL SALVADOR: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodities 3/		1991	1992	1993	1994	1995 e/
Aluminum: metal including alloys, semimanufactures		1,612	2,301	2,000 e/	2,400 e/	2,500
Cement		679,723	419,378	861,424	850,000 r/	875,000
Fertilizer materials:						
Phosphatic e/		8,000	10,515 r/ 4/	10,000	12,000	12,500
Other mixed chemical		48,697 r/	47,926 r/	48,000 e/	54,000 e/	55,000
Gypsum e/		4,500	4,500	5,000	5,000	5,300
Iron and steel: metal:						
Steel, crude		19,000 r/	28,000 r/	37,000 r/	40,000 r/	10,000 4/
Semimanufactures		41,273 r/	45,016	56,021	56,100 e/	57,000
Limestone	thousand tons	1,900	2,200	2,600	2,600 e/	2,800
Petroleum refinery products	thousand 42-gallon barrels	5,662 r/	6,033 r/	6,000 e/	6,100 e/	6,100
Salt, marine		15,000	20,000 e/	30,000	30,000 e/	30,000

e/ Estimated. r/ Revised.

1/ Estimated data are rounded to three significant digits.

2/ Includes data available through May 1, 1996.

3/ In addition to commodities listed, construction materials (clays, gravel, miscellaneous rock, sand, and weathered tuffs) were presumably produced. Available information is inadequate to make reliable estimates of output levels of these commodities.

4/ Reported figure.

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THE MINERAL INDUSTRY OF

FRENCH GUIANA

By Alfredo C. Gurmendi

Because French Guiana is a French Overseas Department, the mining laws and regulations of France prevail in the country. Although the main mine output was gold, the value of production amounted to about 4% of the total gross domestic product of almost $800 million in 1995. Primary gold occurrs in the well-known Precambrian shield area shared by French Guiana with Guyana, Suriname, and Venezuela, but more than 90% of the gold produced in 1995 came from placer operations. Recently, however, exploration activity began to probe the greenstone belts of the Precambrian shield, which in Canada and elsewhere to be the most mineralized parts of the old shield rocks.

The Bureau de Recherches Géologique et Minierès (BRGM) of France completed the mineral inventory of the "North Guiana Trough." Given the significance of the gold potential in the Guiana Shield, the French Ministry of Industry organized a gathering in June 1995 and presented BRGM's latest results of the mineral inventory of the country, including five recently discovered and/or studied gold prospects in northern French Guiana.

Gold had been mined at a number of placer sites in the interior since 1853. Columbite and tantalite also were produced from alluvial deposits. Sand was dredged from the major rivers in the western region of the country, primarily the Mahury and the Maroni. Stone was quarried at Cayenne and to the southeast of Kourou. *(See table 1.)* "Guyanor Ressources S.A. (Guyanor)," a French corporation wholly owned by Golden Star Resources Ltd. (GSRL) of Canada, was issued an "Autorisation Personnelle Minière" (Personalized Mining Authorization) to hold exploration permits, mining licenses, and mining concessions in the country. Guyanor and the Chamber of Commerce and Industry of French Guiana issued a "Declaration of Principle" to facilitate Guyanor's activities in the country, benefiting both interests.

According to GSRL, Guyanor acquired the mineral rights and exploration permits for the Yaou project about 210 kilometers (km) southwest of Cayenne, near Maripasoula. The Dorlin project, about 180 km southeast of Cayenne and 47 km east of Yaou, consisted of six exploration permits, where there is thought to be an excellent potential for the discovery of base metals and gold. Guyanor granted to "Asarco Guyane Francaise S.A.R.L. S.A.R.L.(ASARCO)," of the United States, an option to acquire a 50% joint venture in the Saint-Elie mining concession, 120 km west of Cayenne. ASARCO is required to spend up to $10 million on the property during 1994-99 to explore and evaluate the property, including a feasibility study. Saint-Elie's exploration plans included line cutting, topographical surveying, geologic mapping, geochemical soil sampling, and airborne magnetic and radiometric surveys. There are two additional important gold prospects, the Espérance, in the extreme western part of French Guiana, 100 km south of Saint-Laurent-du-Maroni, and the Regina East, 80 km south-southeast of Cayenne.

France dominated French Guiana's trade, accounting for more than 50% of total imports and exports. Most of the gold produced was exported to France; however, some gold was mined and smuggled out of the country by the Brazilian "garimpeiros" (small-scale independent miners) along the southeastern border. Sand and stone were consumed by the local construction industry. The country depended on imports for its other mineral requirements, especially cement and fuels, which were shipped through the port at Cayenne.

Interest in gold mining was expected to grow further as increasing numbers of companies and investors from Australia, Canada, France, South Africa, and the United States focused on gold opportunities in French Guiana as well as in adjacent Guyana, Suriname, and Venezuela.

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Direction Regional de l'Industrie, de la Recherche et l'Environnement
B.P. 7001
97307 Cayenne, French Guiana

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Gédim (Paris, France): Réalités Industrielles, Annales de Mines, monthly.
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TABLE 1
FRENCH GUIANA: PRODUCTION OF MINERAL COMMODITIES e/ 1/

Commodity		1991	1992	1993	1994	1995
Clays	metric tons	6,000	5,000	5,000	5,000	5,000
Columbite and tantalite	kilograms	1,100	1,100	1,100	1,100	1,100
Gold, mine output, Au content	do.	1,417 2/	2,140 2/	2,500	2,500	2,500
Sand	thousand tons	1,500	1,000	1,000	1,500	1,500
Stone, crushed	do.	1,500	1,400	1,400	1,500	1,500

e/ Estimated.
1/ Includes data available through Apr. 1996.
2/ Reported figure.

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THE MINERAL INDUSTRY OF

GUATEMALA

By David B. Doan

After Bolivia and Mexico, Guatemala has been the third largest producer of antimony in Latin America. Among the metals, Guatemala also produces gold, iron and steel, and lead. It produces some industrial minerals and a variety of construction materials, as well as a low-gravity crude oil. *(See table 1.)* Other minerals known to occur, but not currently worked commercially, included nickel and sulfur.

The gross domestic product was projected at $33 billion[1] in 1994, with a growth rate estimated at about 4% in the midst of an inflation rate of about 12%. As with the overall economy, the mineral industry was dominated by the private sector. Policy for the mineral sector, including required environmental impact assessments, was set by the Ministry of Energy and Mines, which also formulated policy for the petroleum and energy industries. The Ministry of Economy was in charge of approving U.S. projects submitted under the Agreement on U.S. Capital Investment Guarantees between Guatemala and the United States. The band of external tariffs was narrowed and established at 5% to 20% as Guatemala formed a free trade area with El Salvador and Honduras. Guatemala welcomed foreign investors and began streamlining the registration process as an attraction. Mining was governed by Decree Law 69-85 of July 1985, modified by Decree Law 125-85. Small-scale mining was covered by Decree Law 55-90 of December 1990. Both laws were reformed by Congressional Decree Law 41-93 of November 1993. Petroleum activity was covered by the Hydrocarbon Law, Decree Law 109-83, and associated regulations, especially Government Edicts 1034-83 and 203-84. No law specifically covers foreign investment in Guatemala, so most of the restrictions and requirements typically found in such laws do not exist. However, restrictions on foreign investment in specific sectors do apply. The Government provides incentives for hydrocarbon investments by permitting a 100% deductible on all exploration and exploitation expenses. Petroleum investors were eligible for tax-free imports of certain goods for 5 years, suspension of duty without bond on items to be reexported, and were allowed to maintain foreign currency deposits outside the country. Mining operations were similarly allowed duty-free imports.

Mineral output in 1995 was estimated to parallel that of the year before. Antimony ore and concentrate were produced by Minas de Guatemala S.A. from several mines at Ixtahuacán, near the Department of Huehuetenango in the western region of the country. In addition to the recovery of 94% of the antimony values, flotation also enabled the recovery of a concentrate assaying about 124 grams per ton (g/t) of gold. Output was exported mainly to Metaleurop Weser Blei GmbH in France. The company was considering the use of biotechnology for maximum recovery of gold values. The Government invited bids for the El Pato gold prospect, found by a United Nations exploration project, estimated to contain about 2 million tons (Mt) of ore grading 7 g/t of gold.

The cement, ceramics, construction, and glass industries were the country's leading users of industrial minerals. Cement, clays, feldspar, gypsum, lime, and sand and gravel were produced for the local market. Capacity of Cementos Progresso S.A.'s San Miguel plant was expanded by 20% in 1994 in preparation for an expected increase of 8% in 1995 production.

About 80% of Guatemala's oil came from the Xan Field in Peten Province. Basic Resources International Ltd. reported that the fifth Xan well, recently completed, produced 2,000 barrels per day from a depth of 2,321 meters. The company started a small refinery in the Peten area to produce asphalt, naphtha, kerosene, diesel fuel, and distillate fuel oil.

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[1]Where necessary, values have been converted from Guatemalan quetzals (Q) to U.S. dollars, at the rate of Q5.9=US$1.00.

Major Sources of Information

Ministerio de Energia y Minas
Diagonal 17, entre 20 y 30 Calles, Zona 11 Guatemala City, Guatemala
Telephone: (502) (2) 76-0679 or 76-3091
Direccion General de Mineria
Diagonal 17, 29-78, Zona 11
Apartado Postal 1421
Guatemala City, Guatemala
Direccion General de Hidrocarburos
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala
Telephone: (502) (2) 76-2044
Facsimile: (502) (2) 76-3175

Major Publications

Instituto Latinoamericano Del Fierro y el Acero

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(ILAFA), Santiago, Chile: Anuario Estadístico de la Siderurgia y Minería del Hierro de AmÉrica Latina, annual.

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Ministerio de Energia y Minas, Guatemala: Memoria de Labores, annual.

TABLE 1
GUATEMALA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993 e/	1994 e/	1995 e/
METALS						
Antimony:						
Mine output, Sb content		609	582	600	600	610
Trioxide		41	23	30	30	30
Gold	kilograms	31	32	30	30	30
Iron and steel:						
Iron ore, gross weight		5,103	1,445	3,300	3,000	3,200
Steel, crude		23,034	24,500 e/	18,000 r/ 3/	18,000 r/ 3/	18,000
Steel, semimanufactures		79,293	105,000 e/	90,000	90,000	91,000
Lead metal, including secondary		28	49	50	50	50
INDUSTRIAL MINERALS						
Barite		–	1,723	1,500	1,000	1,200
Cement	thousand tons	1,442	1,400 e/	1,119 r/ 3/	1,480	1,560
Clays:						
Bentonite		12,000	12,600	12,300	12,000	12,100
Kaolin		3,281	2,863	3,000	3,000	3,100
Unspecified		1,639	1,597	1,600	1,600	1,700
Feldspar		6,961	8,048	7,500	7,500	7,600
Gypsum		51,519	67,612	60,000	61,000	62,000
Lime e/		72,000	70,000	70,000	70,000	72,000
Pumice and related materials:						
Pumice	cubic meters	6,132	6,591	6,300	6,000	6,200
Volcanic ash	do.	2,476	2,400 e/	2,400	2,400	2,400
Volcanic sand e/		100,000	100,000	100,000	100,000	100,000
Volcanic scoria	cubic meters	9,500	9,975	9,500	9,600	9,500
Volcanic tufa		2,476	2,600	1,900	2,000	1,900
Salt e/		100,000	100 000	100 000	100,000	100,000
Stone, sand and gravel:						
Dolomite		8,318	9,314	10,000	10,000	11,000
Limestone	thousand tons	1,442	1,756	1,500	1,000	1,200
Marble:						
Block e/		9,000	9,000	7,000	7,100	7,300
Chips and fragments		1,851	1,751	1,800	1,750	1,800
Sand and gravel	thousand tons	1,009	758	950	900	1,000
Schist e/		250,000	250,000	250,000	251,000	255,000
Silica sand		17,300	33,714	27,000	27,000	29,000
Stone, crushed e/	thousand tons	1,000	1,000	1,000	1,100	1,200
Talc		861	1 320	800	800	950
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural, gross e/	thousand cubic meters	10,000	13,000 r/	12,000 r/	12,000 r/	12,500
Petroleum:						
Crude	thousand 42-gallon barrels	1,352	2,051	1,700	1,650	1,750
Refinery products	do.	4,639	5,696	5,000	5,100	5,300

e/ Estimated. r/ Revised.
1/ Estimated data are rounded to three significant digits.
2/ Table includes data av le through May 1, 1996.
3/ Reported figure.

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TABLE 2
GUATEMALA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating company and major equity owners	Location of main facilities	Annual capacity
Antimony		Minas de Guatemala S.A. (private, 100%)	Los Lirios and Anabella Mines, Ixtahuacan, Huehuetenango Department	1.9
Cement		Cementos Progreso S.A. (Lambert Freres et Cie. 69.8%; other 30.2%	San Miguel Plant, Sanarate, El Progreso Department, and La Pedrera Plant, Guatemala City	1,800
Nickel		Exploraciones y Explotaciones Mineras Izabal, S.A. [(Exmibal) (Inco, 70%; and Government, 30%) 1/]	Mine and processing plant near El Estor, Izabal Department 2/	9
Iron and steel (semimanufactures)		Hornos, S.A.	Guatemala City	80
Petroleum:				
Crude	thousand 42-gallon barrels	Basic Resources International S.A. [(Basic) (private, 100%)]	Rubelsanto, West Chinaja Fields, Alta Verapaz Department, and Caribe, Tierra Blanca and Xan Fiels, Peten Department	2,000
Products	do.	Texas Petroleum Co. (Texaco Inc., 100%)	Refinery at Escuintla, Escuintla Department	6,200
Do.	do.	Basic (private, 100%)	Refinery near Santa Elena, El Naranjo, Peten Department	720

1/ Ownership equity change in 1991.
2/ Mine and processing plant closed Sept. 1990.

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THE MINERAL INDUSTRY OF

GUYANA

By Alfredo C. Gurmendi

Guyana's principal mineral commodities, namely bauxite and gold, continued to contribute to its favorable trade balance of $120 million in 1995. Bauxite and gold accounted for almost 42% of its exports. In 1995, bauxite production amounted to an estimated 2.1 million metric tons (Mt), or about 2% of the world's bauxite production. Gold output amounted to 11.8 metric tons (t). However, the Omai gold mine, owned by a joint venture between the Canadian firms Cambior Inc. (65%), Golden Star Resources (30%), and the Guyana Government (5%), was forced to close in August when a tailings pond dam burst, spilling cyanide-bearing effluent into the nearby Essequibo River. The Omai Mine was scheduled to return to production by the second quarter of 1996. The completion of its mill expansion, also planned for the second quarter, will increase milling capacity from 12,000 metric tons per day (t/d) to 18,000 t/d. International attention to the Guiana Shield and investment in exploration for gold proceeded steadily, along with increasing exploration interest in diamond. In 1995, Guyana's gross domestic product (GDP) was $1.5 billion,[1] which represented an annual growth of 8.3% with an inflation rate of 7%.

All mineral rights are vested within the State; mining concessions are negotiated with Government agencies. They are the Bauxite Industry Development Co. Ltd. (BIDCO) for bauxite, the Guyana Geology and Mines Commission for gold and diamonds, and the Guyana Natural Resources Agency for oil. The Guyana Gold Board (GGB), established in 1982, has been the sole official buyer of unprocessed gold.

The Government continued to seek private investment for exploitation of mineral deposits. The Mining Act of 1989 limited small- and medium-scale mining to Guyanese citizens only, which led immediately to problems of definition of size. Foreigners were restricted to large-scale mining, except in the case where a claim operator specifically requested foreign technical assistance and the Guyana Geology and Mines Commission supported the work permit application. Foreigners caught illegally mining in the interior were subject to charges and forfeiture of all equipment. Although joint ventures between local and foreign companies were encouraged, 100% foreign ownership of Guyanese operations was allowed.

Environmental review of new projects was the responsibility of the Guyana Agency for Health Sciences Education, Environment, and Food Policy. Emerging environmental problems included mercury contamination of soils and waters resulting from gold recovery by individuals as well as dredges. Microbial contamination of rivers near mining camps has been detected, but is considered easily remedied or prevented.

Guyana was the fourth largest bauxite producer in Latin America after Brazil, Jamaica, and Suriname *(See table 1.)* Declared gold production (the amount sold to the GGB) remained at the same level of the previous year. Traditionally, miners had smuggled much of their recovered gold into Brazil or Venezuela. Since 1990, however, the GGB has paid miners for gold using the current exchange rate rather than the unrealistic old official rate (G$50=US$1 in 1990), thus reducing the attractiveness of smuggling. A small amount of silver, equivalent to approximately 5% of gold output, was recovered during refining of the gold.

The entire bauxite industry was overseen by BIDCO. Bauxite mining and processing were done by BIDCO's subsidiary, Guyana Mining Enterprise Ltd. (Guymine), or under contract to Guymine; however, Minproc Engineering of Australia (MINPROC) assumed management of the bauxite industry from Guymine in 1993. Guymine's operations were split into Linden Mining Enterprise (LINMINE) and Berbice Mining Co. The Government was planning to privatize its bauxite industry in late 1995 or early 1996. A management team of MINPROC will assist LINMINE to improve its standing and determine its salability. Several international companies were actively involved in the bauxite industry *(See table 2.)* The domestic private sector dominated the production of gold and diamonds. Five companies held large-scale mining licenses. There were also about 20 prospecting licenses for gold and precious stones and a number of license applications on file. Local subsidiaries of private foreign firms carried out petroleum exploration, with little discernible success.

Besides its minority interest in Omai, Golden Star was pressing the exploration of its placer deposit concession near Mahdia. South American Goldfields, which had owned the Peter's Mine, Akaiwong, Aurora, Five Star, and Quartz Hill properties, merged with Golden Star to form Golden Star Resources Ltd. Sutton Resources Ltd.

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of Vancouver, British Columbia, pressed its drill work on the Marudi Hill prospect in southern Guyana.

During 1995, Golden Star also continued work on its alluvial diamond evaluation program at Red Hill Loop, Eping, and Apaikwa. Baracara Quarries and Toolsie Persaud Ltd. produced gravel near Bartica. The Government's Teperu-Itabu Quarry was being reopened in response to overwhelming demand for construction materials, and consideration was given to using Omai gold mine waste rock for aggregate and boulders.

Guyana has diversified the formerly bauxite-oriented mineral industry by its 7-year gold and diamond promotion program. The intensive, internationally funded exploration activity has resulted in augmented gold production, which is expected to increase further. Large-scale gold operations, such as those of the Omai Mine, would significantly strengthen Guyana's economy.

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[1]Where necessary, values have been converted from Guyanese dollars (G$) to U.S. dollars at an imputed average exchange rate of G$130.7=US$1.00.

Major Sources of Information

Bauxite Industry Development Co. Ltd. (BIDCO)
71 Main St.
Georgetown, Guyana
Telephone: (592) 2-57780

Guyana Geology and Mines Commission
P.O. Box 1028
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53148
Fax: (592- 2-53047

Guyana Gold Board
c/o Guyana Geology and Mines Commission Compound
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53173

Guyana Natural Resources Agency
41 Brickdam and Boyle Place
Stabroek
Georgetown, Guyana
Telephone: (592) 2-66549
Fax: (592) 2-71211

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TABLE 1
GUYANA: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1991	1992	1993	1994	1995 e
Aluminum: Bauxite, dry equivalent, gross weight	thousand metric tons	2,200	2,380	2,130	2,100 e/	2,100
Diamond	carats	21,900	44,800	50,000 e/	34,000 e/	34,000
Gold, mine output, Au content	kilograms	1,840	2,480	9,610	11,800	11,800
Stone, crushed e/	metric tons	55,000	72,500 3/	75,000 e/	136,000 e/	136,000

e/ Estimated.
1/ Includes data available through Apr. 1996.
2/ In addition to the commodities listed, a variety of crude construction materials (clays and sand) and semiprecious stones was also produced. Availabe information was inadequate to make an estimate of production.
3/ Reported figure.

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THE MINERAL INDUSTRY OF

HONDURAS

By David B. Doan

The Republic of Honduras ranked among the least developed countries in the Western Hemisphere, with a gross domestic product (GDP) of about $9.7 billion.[2] Having an economy based largely on agriculture, employing 62% of the work force, and accounting for about 28% of the GDP, the country faced problems of unemployment, inflation, and dependence on exports of coffee and bananas.

Mining laws in Honduras include Decree 194-84 covering the petroleum industry; a subsequent petroleum and minerals law, Decree 123-90, passed in 1990; and a general mining code passed in 1991. Mineral and petroleum deposits were owned by the Honduran Government. All deposits were available for exploration and exploitation by private companies through concessions, granted to individuals or corporations within the terms of the general mining law. Exclusive exploration concessions to foreigners were granted for 4 years and were renewable for 2 years. Mining concessions were granted for 40 years. All companies were required to have a labor force that is 90% Honduran.

Honduras mainly produced lead and zinc, with ancillary copper, gold, and silver, and minor amounts of cadmium associated with the zinc. Industrial minerals included cement, gypsum, limestone, marble, and salt. Honduras exported about 40% of its metals to Europe and some to Japan, Mexico, the United States, and Venezuela.

The El Mochito Mine near Lake Yojoa, operated by Compania Minera Santa Barbara S.A., a wholly owned subsidiary of Canada's Breakwater Resources Ltd., was the only large operating metal mine in Honduras. Lead and zinc concentrates from the mine, however, contributed less than 2% to the GDP, and less than 0.3% of the labor force was involved in mining. During the year, Breakwater drilled to augment reserves at El Mochito; one hole retrieved 6.1 meters grading 3% zinc, 6% lead, and 168 grams of silver per ton.

The San Andrés Mine, 150 km southwest of San Pedro Sula, was the second largest gold producer in Honduras. The owner, Canada's Greenstone Resources Ltd., projected 554,000 ounces (17,232 kilograms) (kg) of gold proven and probable, and estimated 300,000 ounces (9,331 kg) nearby at a separate deposit. The Cementos de Honduras S.A. is the largest cement company in Honduras, followed by the Industria Cementera Hondurena S.A. de C.V., with capacities of 600,000 tons per year (t/yr) and 450,000 t/yr, respectively. Both companies are privately owned. Salt was produced in the Choluteca district, in the southwestern area of the country. Gypsum and marble were produced primarily for export, and limestone was used in local cement plants.

About 500,000 barrels of oil were produced annually by Texaco Inc. near the Mosquitia coast, although Honduras has several undeveloped oil basins such as Matique, Olancho, Tela, and Ulua. Colombia, Mexico, and Venezuela supplied its crude petroleum. Honduras' Refineria Texaco de Honduras S.A., its only refinery, operated privately in Puerto Cortes, Trujillo Bay, and relied entirely on imported crude. Even so, the country depended on imported petroleum products for domestic consumption.

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[1] Where necessary, values have been converted from Honduran lempira (d) to U.S. dollars at the rate of d10.4=US$1.00.

Major Sources of Information

Direccion General de Inversiones y Promocion de Exportaciones
Ministerio de Economia y Comercio
Plaza Peatonal, Edif. Salame, 4to. Nivel
4ta. Calle, 4ta. Avenida, Tegucigalpa, DC, Honduras
Direccion General de Minas e Hidrocarburos
Ministerio de Recursos Naturales
Boulevard Miraflores, Tegucigalpa, DC, Honduras
Telephone: (504) 32-7848; Fax: (504) 32-5375
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(Apartado Postal 2029)
Centro Comercial Maya, 2do. Nivel
Boulevard Morazan, Tegucigalpa, DC, Honduras
Telephone: (504) 32-0937; Fax: (504) 32-1808

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TABLE 1
HONDURAS: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
Cadmium, Cd content of lead and zinc concentrates		212	333	113	46 3/	32
Cement		693,040	650,000 e/	723,000 r/	615,000 r/	655,000
Copper, Cu content of lead and zinc concentrates e/		1,000	1,600	1,000	500 r/	390
Gold	kilograms	180	163	111	106 3/	110
Gypsum e/		27,000	26,000	25,500	25,500	26,000
Lead, mine output, Pb content		8,719	10,797	3,550	2,810 3/	2,000
Petroleum refinery products 3/	thousand 42-gallon barrels	3,000 e/	1,903	1,900 e/	1,900	2,000
Salt e/		30,000	30,000	30,000	25,000	25,000
Silver	kilograms	39,359	42,847	23,934	24,876 3/	25,000
Building materials:						
Limestone e/		500,000	450,000	400,000	400,000	450,000
Marble	square meters	95,937	100,000 e/	95,000 e/	90,000	93,000
Zinc, mine output, Zn content		38,280	29,008	18,300	16,700 3/	14,500

e/ Estimated. r/ Revised.
1/ Estimated data are rounded to three significant digits.
2/ Includes data available through May 1, 1996.
3/ Reported figure.
4/ Includes LPG, aviation and motor gasoline, diesel, kerosene, and distillate fuel oil.

TABLE 2
HONDURAS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity e/
Cement		Cementos de Honduras, S.A. (private, 100%)	Río Bijao plant., San Pedro Sula, Cortés Department	600
Do.		Industria Cementera Hondureña, S.A. de C.V. (private, 100%)	Piedras Azules plant, Comayagua Department	450
Gold	kilograms	Compañia Minera Santa Bárbara (Breakwater Resources Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	300
Do.	do.	Cia. Minerales de Copan, S.A.(Greenstone Resources Ltd. 92%; controls other 8%.)	San Andrés Mine, Copán Department	150
Lead		Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	35
Petroleum products	thousand 42-gallon barrels	Refinería Texaco de Honduras, S.A. (Texaco, Inc., 100%)	Puerto Cortés, Cortés Department	5,040
Silver	kilograms	Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	50
Do.	do.	Cía. Minera El Paso Mining (private, 100%)	La Pochota Mine, Valle Department	20
Steel		Aceros de Honduras, S.A. (100%)	Choloma, Cortés Department	14
Zinc		Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Monchito Mine, Santa Bárbara Department	30

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THE MINERAL INDUSTRY OF

JAMAICA

By Ivette E. Torres

Jamaica's economy grew modestly by 0.5% in 1995 (constant dollars).[1] Inflation, as measured by the consumer price index, was 25.5%, a small decrease from that of 1994. The value of the Jamaican dollar decreased by 6.2% in relation to the U.S. dollar. Some sectors of the economy, including construction, showed healthier growth patterns than the general economy, but the mining and quarrying sector decreased by 6.4% from that of 1994. The manufacturing sector decreased by 1%.

By world standards, Jamaica is a modest producer of minerals. However, it is a leading world producer of bauxite and alumina. Mining and quarrying contributed to 8.6% to the gross domestic product (GDP) in 1995. Of this, 98% was from bauxite and alumina. In 1995, Jamaica ranked third in output of alumina after Australia and the United States. It also ranked third in the production of bauxite after Australia and Guinea. Accordingly, production of bauxite and alumina dominates Jamaica's mineral sector and is a significant contributor to the GDP and an important source of foreign exchange.

Jamaica's other production of metal commodities is limited to a small amount of steel and secondary lead. Jamaica also produces modest quantities of industrial minerals such as cement, gypsum, salt, and stone. The country depends totally on imports for its supply of petroleum. Petrojam Ltd., owned by the Petroleum Corporation of Jamaica (Government) is the only petroleum refinery in the country.

Most of the production levels of the mineral commodities produced in Jamaica increased in 1995. The most significant exception, because of its dominance of the sector, was the decrease of the output of bauxite and alumina. Production of bauxite and alumina decreased by 6.1% and 5.9%, respectively, from that of 1994. The alumina decrease was in part the result of work stoppages because of strikes at all refineries. Industry management has expressed concern over the production costs and efficiency in Jamaica's alumina plants, in particular, after new labor contracts were in place in 1995.[2] Plans to increase alumina production capacity in Alcoa Minerals of Jamaica Inc. (Jamalco) from 850,000 metric tons per year to 1 million metric tons per year and in Aluminum Partners of Jamaica (Alpart) from 1.45 million tons per year to 2 million tons per year have been influenced by those concerns and seem to be on hold in the near future. In contrast, plans for the Trelawny alumina project in northern Jamaica were progressing.[3] A feasibility study for the 1-million-ton alumina project was scheduled for 1995, with exploration, environmental impact assessment, and laboratory work to be completed by yearend. Final engineering and financial studies were scheduled for 1996. The project is being undertaken by the Jamaican Bauxite Institute and the Canadian company Alcan Aluminum Ltd., the parent company of Alcan Jamaica Co. (Jamalcan).

The production of silica sand, consumed mainly in glass containers by the beverage industry, decreased 11.4%, down for the second consecutive year because of the increased usage of plastic by the beverage industry to replace glass containers. The most severe output decrease was achieved by the marble industry, which reduced its production during the year by 51%. According to the Economic and Social Survey Jamaica 1995, the production decrease was attributed to the need for investment to expand the production required to meet the domestic demand and to the reluctance from both licensed mining contractors and land owners to invest-- not to the lack of demand. While Jamaica reduced its production levels of marble in 1995, imports of marble slab from nearby Cuba and other areas of Latin America were increased.

As construction increased in Jamaica, output of most of the commodities that supply the needs of the sector increased accordingly. The most notable production increase was that of cement, which increased by 17% to 523,562 tons. The large increase in cement production was attributed to an increase in construction and building. Even though increased activity in that sector was not as notable as the increase of cement output, part of the significant increase was due to the size of public sector projects that were under construction and/or expansion during the year.

In the case of gypsum, output increase was not due to an increase of domestic consumption but to an increase in demand by the Latin American and Caribbean markets to which Jamaican gypsum was being exported, of which exports of gypsum to Brazil increased the most.

Production of petroleum refinery products decreased in 1995. Petrojam, the producer, and some of its subsidiaries are some of the Government companies planned to be privatized. Originally, the Government intended to divest itself completely of Petrojam; however, it decided to retain

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51% majority equity in the company.[4]

In 1995, various companies were exploring for gold and copper in Jamaica.[5] BHP Minerals International Exploration Inc., Kennecott Corp., and Orvana Minerals Corp. were among them. Orvana, of Vancouver, Canada, continued to work through its subsidiary Clarendon Mining Ltd. on the Central Inglier gold deposit and the project was leading to the feasibility study phase at yearend.

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[1]The Planning Institute of Jamaica. Economic and Social Survey Jamaica 1995, p. 1.2.

[2]Platt's Metal Week. Jamaican Alumina Industry Faces Rising Costs, July 31, 1995, pp. 5-7.

[3]Metal Bulletin. Jamaica Advances Trelawny Alumina Project. V. 326, No. 8372, Apr. 6, 1995, p. 7.

[4]Petroleum Economist. News in Brief. Jamaica, Aug. 1995, p. 28. Mining Investment Conference Review, Apr. 1995, p. 15.

Major Sources of Information

Commissioner of Mines
Ministry of Production, Mining and Commerce
P. O. Box 189, Hope Gardens
Kingston, Jamaica, WI
Telephone: (809) 927-1936

The Jamaican Bauxite Institute Ltd.
P. O. Box 355, Hope Gardens
Kingston 6, Jamaica, WI
Telephone: (809) 927-2071; Fax: (809) 927-1159

Petroleum Corporation of Jamaica
12 Ocean Boulevard
Kingston 6, Jamaica, WI

Planning Institute of Jamaica
8 Ocean Boulevard
Kingston, Jamaica, WI
Telephone: (809) 967-3689-92; Fax: (809) 967-3688

TABLE 1
JAMAICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
Aluminum:						
Bauxite, dry equivalent, gross weight	thousand tons	11,600	11,300	11,400	11,564 r/	10,857
Alumina	do.	3,015	2,917	2,989	3,221 r/	3,030
Cement, hydraulic	do.	388 r/	474 r/	451	446 r/	524
Gypsum		135,840	144,970	152,190	203,700 r/	208,020
Iron and steel, steel, crude		24,385 r/	24,690 r/	24,500 e/	24,500 e/	24,500 e/
Lead, refined (secondary) e/		1,000	1,000	800	800	800
Lime		95,000	179,000	151,000	170,000	170,000 e/
Petroleum refinery products	thousand 42-gallon barrels	6,858 r/	8,763 r/	5,774 r/	5,886 r/	5,364
Salt		17,255 r/	21,095 r/	17,970 r/	17,543 r/	19,341
Silica sand		15,620	20,420 r/	21,300	18,400 r/	16,300
Stone:						
Limestone	thousand tons	2,900 r/	3,161 r/	3,319 r/	3,319 r/	3,385
Marble, cut and/or polished		4,000 r/	4,620	5,780	5,720 r/	2,800
Marl and fill	thousand tons	2,950	3,451 r/	3,627	3,809 r/	3,920
Sand and gravel	do.	1,214	1,347	1,549	1,700 r/	1,800

e/ Estimated. r/ Revised.

1/ Table includes data available through Oct. 1, 1996.

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TABLE 2
JAMAICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Alcoa Minerals of jamaica Inc. (Jamalco) (Aluminum Co. of America, 50%; Clarendon Alumina Production Ltd., (Government) 50%)	Halse Hall plant at Clarendon, Clarendon Parish	850
Do.	Alumina Partners of Jamaica (Alpart) (Kaiser Aluminum Corp., 65%; Hydro Aluminum Jamaica AS, 35%)	Nain, St. Elizabeth Parish	1,450
Do.	Alcan Jamaica Co. (Jamalcan) (Alcan Aluminum Ltd. Canada, 93%; Government, 7%)	Kirkvine, Manchester Parish, and Ewarton, St. Catherine Parish	548 548
Bauxite	Jamalcan Bauxite Mines	St. Ann and St. Catherine Parishes	1,600
Do.	Jamaica Bauxite Mining Ltd. Lydford Mines	Lydford, St. Ann Parish	2,500
Do.	Jamalco Bauxite Mines	Mocho Mountains, Clarendon Parish	2,500
Do.	Kaiser Jamaica Bauxite Co. Ltd.	Kirkvine, Manchester Parish; Water Valley, Discovery Bay, St. Ann Parish	4,500
Cement	Caribbean Cement Co. Ltd.	Rockfort. St. Andrews Parish	1,700
Petroleum products	Petrojam Ltd. (Petroleum Corp. of Jamaica, 100%)	Kingston, St. Andrews Parish	36,000 1/

1/ 42-gallon barrels per day.

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THE MINERAL INDUSTRY OF

MEXICO

By David B. Doan

In the midst of a gradual recovery from the financial crisis and peso devaluation of late 1994 and in spite of minor political unrest in rural areas of one or two southern States, Mexico's mineral industry marked 1995 as a year in which production of metal ores forged ahead while output of industrial minerals was slowed by the effects of recession. Notwithstanding a fall of nearly 7% in gross domestic product and a plunge of about 50% in the value of the peso against the dollar, Mexico maintained its position of prominence in mineral production, once again leading the world in output of silver among the metals and strontium (celestite) and sodium sulfate among the industrial minerals. Mexico was among the world's top five producers of antimony, (white) arsenic, barite, bismuth, fluorspar, and graphite; beyond these, it was one of the top ten producers of cadmium, copper, gypsum, lead, manganese, molybdenum, salt, sulfur, and zinc. Throughout the Western Hemisphere, only Mexico and Brazil produced manganese in significant quantities.[2] Mexico remained in sixth place in terms of world output of petroleum crude.

Mexico's economic problems began in December, 1994, about a year after ratification of the North American Free Trade Agreement (NAFTA), with a serious financial crisis involving collapse of the peso and, briefly, an almost total loss of international confidence in the country's financial structure. Although recovery of the banking system and the rebuilding of confidence are a separate story, the mining industry performed well in supporting domestic demand, export earnings, and cash- flow into mining's labor sector amidst the sharp drop nationwide in purchasing power.

The notable gains in Mexico's metal mining sector versus the bleak picture in the overall economy arose from several factors, starting with the general improvement in metals prices in world markets. This alone furnished impetus to plans for new mines and expansion of existing production but, simultaneously, the peso devaluation abruptly lowered relative operating costs, including payroll obligations, of all Mexican mines. Valuation of output continued at dollar-denominated prices set by world markets, thus enhancing peso revenues to levels much higher than normal and fostering increased contributions to revenues by exports. Less obviously, but nonetheless significantly, the long program of privatization of mining properties inherited from two previous (1982-88 and 1988-94) administrations bore fruit as former State-owned mines, newly privatized, increased efficiency and realized expanded production at virtually the same operating costs. Furthermore, Mexico's mineral sector received infusions of hard currencies. According to the Mexican Mining Chamber, $1.17 billion[3] was invested in the mining industry during the 1992-94 period. Moreover, the Chamber forecast that at least $5 billion more will be invested during the 1995-2000 period.

Several new projects and specific properties were prominent as invested capital continued to be applied in 1995. In Baja California, Grupo Frisco put $20 million into the opening of a gold project at San Felipe. The company also invested $30 million in a high-grade copper project, called "Mariquita", in Sonora, and were reviewing a gold-silver project, named "Santa Fe", in Chiapas. Industrias Penoles S.A. put $70 million into a gold-silver mine in Durango, called "La Cienega," that began operations during 1995. Grupo Sanluis, after investing $45 million to reopen the old, flooded El Oro gold and silver mine in the State of Mexico, put another $5 million into exploration of the Metates project in Durango, a low-grade gold project with 500 million tons (Mt) of ore reserves. The same company invested $3 million in two gold projects, one at San Martin in Queretaro and the other at Promontorio, in Durango. With operations starting at yearend 1994, San Martin was responsible for the 30% gold production increase of Grupo Sanluis. Other prospects, particularly gold and copper, were being explored by Mexican and foreign mining enterprises.

Government Policies and Programs

Priority continued to be given to Government privatization efforts that began in the last part of the 1980's and that,by 1995, have placed almost all former State-owned mines in private hands.

Under the 1917 Mexican Constitution, minerals were considered to be part of the national patrimony. The Government awarded concessions for exploration and exploitation of nonfuel minerals. In most cases, foreign participation in the nonfuel mineral sector was limited to no more than 49% ownership. The 1961 Mining Law imposed a requirement for a majority Mexican participation, both in equity and management of mining companies. The 1961 law granted a 25-year grace period for "Mexicanization" of the industry, but most companies in the mining industry were Mexican-controlled within 10 years. The 1975 Mining Law gave the Government even more control over mining activities. The law limited foreign participation to 34% in concessions on national reserves and all projects exploiting certain minerals, such as iron ore and coal. Exploitation of oil and gas, phosphate rock, potassium, sulfur, and uranium was reserved for the Government. In 1990, a regulation

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issued by the Secretaria de Energia, Minas e Industria Paraestatal (SEMIP), allowed more flexibility in foreign ownership through exploration and production trusts undertaken in keeping with the 1975 Mining Law.

Regulations of the most recent mining law, which became effective in September 1992, as well as the Manual de Servicios al Publico en Materia Minera, (referred to hereafter as "The Mining Law") were published on March 25, 1993, in the official gazette. This law allowed the private sector to play a much larger role in the mining industry as the Government of Mexico privatized State-owned companies, decontrolled its mining reserves, and encouraged domestic investment and foreign participation in the mining industry. The law permitted direct investment, with up to 100% ownership of the capital stock, in exploration works and activities. It also allowed, through a 30-year trust mechanism, up to 100% foreign participation in mine production. The Mining Law provided greater legal security for holders of exploration and exploitation concessions, and allowed private-sector participation in the exploitation of mineral deposits previously considered as priority and strategic within the domain of Government ownership, such as coal, iron, phosphorus, potassium, and sulfur. The Mining Law extended the term of exploitation concessions from 25 to 50 years, renewable for a similar period, while exploration concessions were to be for a nonrenewable 6-year period. It allowed exploration and mining, through competitive bidding, for minerals on the continental shelf and underwater shelves of islands, as well as the seabed and subsoil of the exclusive economic zone extending 200 miles offshore as defined by the Law of the Sea and the United Nations. The only limiting factor of these concessions was that they were nontransferable.

Exploitable substances not covered by The Mining Law included the following:

- Petroleum and solid, liquid, or gaseous hydrocarbons.
- Radioactive minerals.
- Substances contained in suspension or dissolution in subterranean waters, as long as they did not originate from a mineral deposit different from the components [sic] of the land.
- Rocks or the products of their decomposition that could only be utilized for the fabrication of materials for construction or ore destined for such purposes.
- Products derived from the decomposition of the rocks, whose exploitation was performed principally by open pit work.
- Salt that came from salt pits formed by evaporation of brines in river basins.

The Mining Law eliminated the need for concessions for ore preparation plants. Individuals engaged in processing minerals subject to this law would be obligated to inform the Government when their operations began, submit the relevant reports, and comply with the general regulations and specific technical standards in the area of environmental control.

In practical terms The Mining Law brought greater flexibility to the management of mining affairs; eliminated excessive red tape; stimulated small- and medium-scale mining production; and promoted private-sector investment in exploration and mining activities. The beneficial aspects of this law, combined with the 1989 reduction of corporate income tax to 35% and the 1991 elimination of the mineral production tax, have led to an increase in new mining projects. The number of mining claims issued has doubled from 2,000 annually to more than 4,200. The land area covered by mining concessions has increased from 2.8 million to 7.1 million hectares.

Environmental Issues

Although various environmental laws and regulations had been promulgated since 1946, protection of the environment became a priority for the Government of Mexico as population, technology, and mining grew in size or importance. Accordingly, a key element of environmental legislation was passed in 1992 named "The General Law of Ecological Balance and Environmental Protection" or LGEEPA. Environmental responsibilities residing in various Government agencies were transferred to a new Ministry of Environment, Natural Resources, and Fisheries (SEMARNAP), having broad powers. Enforcement of environmental regulations was to be buttressed by the newly formed Environmental Attorney's Office.

Under the new SEMARNAP, mineral exploration and mining required a number of environmental permits and authorizations to conform to the statutes of LGEEPA, starting with a preliminary environmental impact statement for all major activities or projects. Besides an operating license, necessary permits for any mine or plant included water well usage, water discharge, land use, explosives, and hazardous materials handling.

There were also regulations concerning noise, gas and dust emissions, dumps and tailings, storage of oil and fuel, and electrical transformers.

Water discharge regulations were specified in the "National Water Law" of December, 1992, and the preceding "Federal Law Concerning Water Rights" (LFDMA) of January 1992. According to LFDMA, water pumped from mining works was not subject to discharge fees, so long as it was not used in the "exploitation and/or metallurgical treatment of ore" or for other industrial or domestic use. In any case, however, discharge fees were required for water containing more than 2,500 milligrams per liter of total dissolved solids, unless the discharged water was able to meet the minimum quality standards set by the Consejo Nacional de Agua (CONAGUA). Although water discharged to runoffs or water basins was also exempted from payments of discharge fee if it met CONAGUA water quality standards, all other types of water discharge required payment of a fee according to schedules set by LFDMA.

Production

Overall, the production of antimony, barite, celestite, coal,

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coke, copper, gold, graphite, fluorspar, iron, manganese, molybdenum, and silver increased in 1995, compared with that of 1994, while production of arsenic, bismuth, cadmium, gypsum, lead, and zinc declined. Output of selenium and tungsten, produced as byproducts, had been suspended in 1993 for lack of profitability.

The total value of Mexican mining production in 1995, excluding cement and petroleum, was $3.94 billion, or slightly less than the $4.19 billion of the previous year. The overall loss was attributable solely to the nonmetallic or industrial minerals, whose value of production in 1995 fell from that of 1994 to about $1.4 billion, a drop of $722 million.

The $3.94 billion total for 1995 comprised the following subtotals: nonferrous metals, $1,685 million; nonmetallic (industrial) minerals, $1,380 million; precious metals, $679 million; and manganese plus iron, $192 million. Individually, copper was the most important metal in terms of value ($1,041 million), trailed by zinc ($419 million), with silver following closely ($418 million). Value of produced gold was approximately $251 million.

Gray portland cement was the most valuable nonfuel mineral product in Mexico, but the total value of 1995 output was $2.6 billion, down $1.14 billion from 1994. This reflected the effect of the economic recession on domestic consumption as well as the devaluation, even though domestic cement prices increased approximately 87% in terms of pesos during the year.

In the industrial mineral sector (excluding cement), sand was the most important in terms of value, at $253 million, followed by gravel ($219 million); limestone, excluding that for cement ($113 million); gypsum ($95 million); and marble ($63 million). Petroleos Mexicanos (PEMEX) saw its 1995 production of petroleum crude drop about 2.5% below that of 1994 as the result of hurricane effects on operations offshore. Production of natural gas was less affected, however, and climbed almost 4% compared with the previous year. Output of coal in 1995 rose about 3% over that of 1994. *(See table 1.)*

Trade

Total Mexican exports of goods and services in 1995 amounted to an estimated $79.5 billion, up about one-third from $60.9 billion in 1994, and testifying to the trade advantages of devaluation. Imports totalled $72.2 billion, down from $79.4 billion in 1994 and reflecting diminished business activity during the recession. Approximately 67% of Mexico's mineral exports went to the United States, while more than 60% of its mineral imports were from the United States. Mexico was a major exporter of such metals as copper, lead, manganese, silver, and zinc and such industrial minerals as cement, fluorspar, graphite, gypsum, salt, sodium sulfate, and sulfur.

PEMEX International (PMI), the trading arm of PEMEX, exported approximately 1.3 million barrels per day (Mbbl/d) of crude oil, of which 1.094 Mbbl/d went to the Americas (chiefly the United States), 134,000 barrels per day (bbl/d) went to Europe, and 77,000 bbl/d went to Asia. PMI's trade operations brought in about $7.5 billion to Mexico during 1995.

Mexico has expanded trade with its Latin American neighbors through other free trade agreements, including an agreement with Colombia and Venezuela in 1994. Seeking to expand its economic and trade ties beyond the Americas, Mexico joined the Asia Pacific Economic Cooperation forum in November 1993 and the Organization of Economic Cooperation and Development in April 1994.

After its implementation on January 1, 1994, one impact of NAFTA on the financial sector became apparent in the second half of 1994 when the Mexican Government authorized 51 subsidiaries of U.S. and Canadian financial institutions to operate in Mexico.

Structure of the Mineral Industry

The Government's participation in the mining sector continued to change as more State-owned entities were privatized. In late 1994, a reorganization of SEMIP moved the Direccion de Minas, Comision de Fomento Minero (CFM), the Consejo de Recursos Minerales (CRM), the Fideicomiso de Fomento Minero (FMNM), and the Mining Directorate to the Secretaria de Comercio y Fomento Industrial, known as SECOFI. PEMEX and the Comision Federal de Electricidad remained part of SEMIP, which was renamed The Secretaria de Energia, known simply as SE.

Of these entities transferred, CFM was formed in 1934 to promote mining activity through financial support, technical advice, and assistance to the medium and small mines. It was also responsible for constructing and operating regional mineral processing plants and research facilities. CRM, formed in 1975, was responsible for mineral exploration and statistics. Under The Mining Law, CRM was also given the ability to provide technical assistance, such as reserve verification, to promote further the small- and medium-sized mines. FMNM's function had been to promote the development, mining, and processing of industrial minerals. In 1990, the managements of CFM and FMNMwere merged with research laboratories and assigned to CRM.

The Mining Directorate gained control over mineral concessions and the national mineral register, plus responsibility for updating and revising mining laws and regulations.

Other organizations within the the Mexican mining community included Cámara Minera de México, widely known as CAMIMEX, which promoted the interests of the mining industry as well as dialogue between the Government and the private industry. The trade union, Sindicato Nacional de Trabajadores Mineros, Metalurgicos y Similares de la Republica Mexicana, represented nearly all the mine workers in Mexico. The cement industry union was controlled by the Confederacion de Trabajadores de Mexico, or CTM, the largest Mexican labor union. In 1995, direct employment in the mining sector was 210,000 workers,

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compared to 175,000 in 1994.

Five large and diversified private-sector companies dominated the production of nonfuel minerals, as shown in table 2. These were Corporacion Industrial Sanluis S.A. de C.V. (Sanluis); Empresas Frisco S.A. de C.V. (Frisco); Industrias Penoles S.A. de C.V. (Penoles); Grupo Mexico S.A. de C.V., formed in August 1994 as a result of reorganization of Grupo Industrial Minera Mexico S.A. de C.V. (IMMSA) and its subsidiary Mexico Desarollo Industrial Minero S.A. de C.V.; and the Grupo Acerero del Norte, S.A. de C.V. (GAN). GAN owned Real del Monte y Pachuca, Minera el Baztan, Magistral del Oro, Barita de Sonora, Minera del Norte, Cerro del Mercado, Minera Carbonifera Rio Escondido (MICARE), Minerales Monclova, and two other corporations related to energy and chemicals. The cement industry was dominated by Cementos Mexicanos (CEMEX), Cementos Apasco S.A. (Apasco), and Cementos Cruz Azul S.C.L. (Azul).

Under Article 27 of the Mexican Constitution, the production of crude oil, natural gas, and basic petrochemicals was reserved for the Government through PEMEX, the Government-owned monopoly, through its four subsidiaries:

- Exploracion y Produccion— charged with the exploration and exploitation of oil and natural gas.
- Refinacion— controlled the industrial refining processes, the manufacture of petroleum products, and basic petroleum derivatives and the distribution systems.
- Gas y Petroquimica Basica— managed processing of natural gas, natural-gas liquids, and the production of basic petrochemicals.
- Petroquimica— controlled production of secondary and tertiary petrochemicals.

Each PEMEX subsidiary managed its own budget, planning, operations, and the transport, storage, and sales of its products. Private investment was not allowed in exploration, exploitation, and refining, but was allowed in secondary and tertiary petrochemical operations. In 1995, the implementing regulation of Article 27 was changed to allow private-sector participation in natural gas transmission, distribution, and storage.

At yearend 1995, PEMEX had approximately 135,524 employees in its work force, most of whom were represented by the Petroleum Workers Union. This figure was down from 215,000 in 1989, a peak year, and reflected the various measures undertaken by PEMEX to reduce its costs and improve its efficiency.

A gradual but predictably long-term change in the mining industry of Mexico has been the influx of more than 100 U.S. and Canadian exploration companies, many of which have set up field offices in the Hermosillo area of Sonora.

Commodity Review

Metals

Copper.—In 1995, mine production of copper increased about 9% from that of the year before. Mexicana de Cobre S.A. was the leading producer with 51% of national output, all from its La Caridad mine and its new plant, which started up in midyear, that utilizes solvent extraction and electrolytic deposition (SX-EW). With a capacity of 1.08 million cubic meters (Mm^3), this operation was expected to produce about 21,000 metric tons (t) of cathodes per year.

Mexicana de Cananea S.A.'s Cananea mine was the second greatest producer, followed by the Maria mine, owned by Minera Maria S.A. de C.V., a joint venture between Empresas Frisco S.A. de C.V. (51%) and Cominco Resources International (49%). The newest copper producer in Mexico, the high-grade underground Maria mine started up in late 1990 and achieved full production in 1991. It produced a total of 210,000 t of ore with an average grade of 9% copper during 1992. The 1,000-ton-per-day (t/d) concentrator came on-stream in November 1991. Total copper production amounted to 16,600 t in 1993, 8,600 t in 1994, and 1,730 t in 1995. The Maria mine closed in 1995, to be replaced by a new operation named La Mariquita that was expected to begin production in 1997. These three mines, La Caridad, Cananea, and Maria, all in the State of Sonora, accounted for 87% of Mexico's total production of copper in 1995.

Other significant copper-producing States were, in descending order of output, Zacatecas, Chihuahua, San Luis Potosi, Durango, and Michoacan.

Mexico's 1995 production of refined copper was 2.5% more than that of 1994. The Cobre de Mexico refinery accounted for more than 60% of refined copper production, followed by the Cobre de Pasteje refinery and the one at Mexicana de Cananea. Much of the anode and blister copper produced by Cananea and La Caridad was transported to Mexico City, where it was refined in Cobre de Mexico's electrolytic refinery. In response to the environmental problems of Mexico City, some of this work was transferred to the company's new facility in Celaya, Guanajuato.

Copper reserves in Mexico were as follows: La Caridad had 469 Mt of ore grading 0.53% copper and 0.03% molybdenum for the flotation plant, and 203 Mt of semioxidized or low-grade ore averaging 0.24% copper for solvent extraction and electrowinning, or SX-EW. Cananea had 1,605 Mt of ore grading 0.61% copper, plus 823 Mt of semioxidized or low-grade ore averaging 0.25% copper. The El Arco project, in Baja California Norte, had 600 Mt grading 0.60% copper.

Gold.—Interest in exploration for gold by both domestic and foreign mining companies increased steadily in Sonora, Baja California, Chihuahua, Durango, Guanajuato, and Sinaloa. After successes in the western region of the United States, some companies found great attraction in the southward extension of the prolific Cordillera and Basin and Range geologic provinces into Mexico. Many of the foreign companies seeking gold established investment trusts that allowed 100% foreign ownership of their exploration efforts in Mexico.

Mine production of gold surged to 20.3 t in 1995, an increase of 43% over 1994 production that was notable in

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the annals of Mexican gold production. Although world gold prices had more or less stabilized, these prices were high enough above typical efficient mining costs that gross profits of $3,200 to $4,800 per kilogram (kg) were possible. In the more common language of mining companies this translated as $100 to $150 per troy ounce. Most, if not all, gold mines produced silver as their primary product. Sonora was the leading gold producing State, contributing about 33% of the national output. Durango was second with 20%, Guanajuato with 14%, and Baja California with about 14%. Sonora's Cucurpe municipality, which included the Santa Gertrudis mine, owned 49% by U.S.-based Phelps Dodge, increased its gold output in 1995 to more than 2,693 kg.

Newly opened mines accounted for most of the overall expansion of production. At yearend 1993, Minera Hecla's La Choya operation in northwestern Sonora began production at its open pit operation. Eldorado Corp. Ltd.'s La Colorada operation began recovering gold the previous year and, in 1995, produced 1,247 kg. Sanluis began operation at the San Martin project in Queretaro in the last quarter of 1993, and in 1995, was able to produce 488 kg. During 1994, Penoles started the Cienega, a polymetallic underground mine that yielded gold associated with other metals. Other promising projects included the Empresa Minera Can Mex's property at Mulatos, Sonora (owned by Placer Dome of Canada), and Cambior's "Metates" project in Durango. The Promontorio project of Sanluis, in the San Dimas District of Durango, involved the development of richly mineralized veins in the southeast part of the district near the Tayoltita area.

Iron and Steel.—The 1995 production of pig iron jumped 22% compared to the preceding year. Direct-reduced iron (sponge iron) production increased 15%, and crude steel production was up 18%. During 1995, 62.5% of crude steel was produced by electric furnace, while 37.5% was produced by basic oxygen converter. The open hearth process was no longer used in Mexico, which was the second largest steelmaker in Latin America after Brazil, producing about 25% of the Latin American output. Mexico's steel exporters enjoyed the benefit of the abrupt peso devaluation in the financial crisis of December 1994. They prospered throughout 1995 as the result of very competitive lower dollar-denominated prices for their export goods, whose production costs were paid for in pesos. These 1995 exports soared to about 6.3 Mt of semifinished and finished steel products worth $2.7 billion, while Mexico imported 1.1 Mt of semifinished and finished products worth $1 billion. Exports of semifinished and finished products in 1994 had been 2.4 Mt valued at $1.1 billion, while imports of semifinished and finished products in 1994 totalled 3.1 Mt valued at $2.7 billion.

Technological improvements, as in the United States, were resulting in less rather than more semiskilled and unskilled labor in the industry, but enhanced the net return for companies making the changes.

The largest steel producer in 1995 was Altos Hornos de Mexico S.A. (AHMSA), with 3.10 Mt; followed by Hylsa de Mexico S.A. (HYLSA) in Monterrey, 2.47 Mt; IMEXA, previously known as SICARTSA II, 2.26 Mt; and Siderurgica Lazaro Cardenas-Las Truchas S.A. (SICARTSA I), 1.44 Mt; Tubos de Acero de México S.A. (TAMSA), with facilities in Veracruz and headquarters in Mexico City, was the fifth largest producer of crude steel at 0.551 Mt. TAMSA's most important domestic client was PEMEX, for tubular steel. Finally, small-mill production amounted to 2.31 Mt.

Steel industry plans were to invest at least $1.7 billion in the next few years as follows: AHMSA, $400 million; Villacero, $250 million; Ispat, $250 million; HYLSA, $200 million; IMMSA (now Grupo Mexico), $110 million; and the other companies, $490 million.

Lead and Zinc.—Mexico continued as the sixth largest producer in the world of lead and zinc. In 1995, Mexico produced about 5.8% of the world's output of lead and 5.2% of world's output of zinc. Most of this output was associated with the production of silver. The leading producers of lead and zinc were Grupo México (formerly IMMSA), Frisco, and Penoles. The six leading lead and zinc producing States were Chihuahua, Zacatecas, San Luis Potosi, Hidalgo, Durango, and Guerrero.

Not only did firmer 1995 world lead prices reflect increased demand for lead-acid vehicle batteries in many industrialized nations, but Mexico's devaluation made its lead offerings very competitive. All of this resulted in enhanced financial results for the year for Mexico's principal lead producers: Grupo Mexico, Frisco, and Penoles.

The largest lead producer in 1995 was Frisco's Minera Real de Angeles S.A. de C.V. mine in Zacatecas, which turned out 34,800 t of lead, followed by the Cia. Fresnillo S.A. de C.V. mine in Naica, Chihuahua, which produced 34,000 t of lead. Frisco's other major producer, the San Francisco del Oro mine, near Hidalgo del Parral in Chihuahua, produced 15,800 t of lead.

The Tizapa project in the State of Mexico, a joint venture between Penoles and Dowa Mining Co., aimed to exploit a zinc-silver-lead deposit that initiated production in 1994 at a start-up rate of 700 t/d of ore lifted. A massive sulfide deposit, Tizapa had an estimated 4 Mt of ore grading approximately 8% zinc, 2% lead, and 250 grams per ton (g/t) of silver. The presence of graphite and iron minerals in the ore has led to metallurgical problems causing low recovery rates in processing.

The leading zinc producer was Sombrerete in Zacatecas, owned by Grupo Mexico, which turned out 46,031 t, followed by Frisco's Noria de Angeles in the same State, 40,483 t; Bismark, 34,249 t; Frisco's San Francisco del Oro in Chihuahua, 30,308 t; and Grupo Mexico's Santa Barbara operation in Chihuahua, which produced 24,657 t.

Mexico's largest new mining project, the Bismark zinc mine, started up in mid-1992 near the U.S. border in Ascension, Chihuahua, but its flotation plant did not reach capacity level of 2,500 t/d in 1994. Bismark reported reserves of approximately 8.8 Mt of ore grading 8.5% zinc and 69 g/t silver. Minera Bismark S.A. de C.V. was

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originally a joint venture between Penoles (40%), Cyprus Minerals (40%), and Promociones Industriales Banamex (20%); but Penoles bought out Cyprus and controlled 80% of the shares.

Silver.—Continuing as the leading producer of silver with 17% of world production, Mexico lifted ore containing 2,496 t of silver from its mines in 1995, representing an increase of 5% over the output of the previous year.

About 85% of Mexico's silver production came from six States: Durango, Chihuahua, Durango, Guanajuato, Hidalgo, Sonora, and Zacatecas. The leading producers in 1995 were Penoles, 937,700 kg; San Luis, 155,000 kg; Frisco, 331,673 kg, of which 262,725 kg came from Real de Angeles Mine; and Grupo Mexico, 666,514 kg. In addition, byproduct silver from Mexicana de Cobre amounted to 77,381 kg, and byproduct silver from Mexicana de Cananea was 17,038 kg. The Fresnillo Mine in Fresnillo, Zacatecas, a joint venture between Penoles (60%) and AMAX (40%), yielded about 631,200 kg of silver in 1995, sustaining its leadership as the largest single producer of silver in the world.

Most Mexican refined silver came from facilities that also refined lead and zinc. The Penoles facility at Torreon, Coahuila, and the Grupo Mexico plant in Chihuahua refined lead concentrates and produced large quantities of silver in the process. Silver was also produced from zinc concentrates at both of these facilities. The Cobre de Mexico refineries in Mexico City and Celaya, Guanajuato, extracted silver electrolytically from copper anodes. Real del Monte in Pachuca has a precious metal refinery that processed silver and gold from the mine's own concentrates as well as concentrates of other mines.

Mexico dramatized the country's silver production by issuing new 10-peso, 20-peso, and 50-peso silver coins in 1993 in a move to monetize and thus support the "new" peso, adopted during the Salinas Administration.

Industrial Minerals

Cement.—Mexican cement production dropped 18% in 1995 to 24 Mt, a decrease due in no small part to the effect of the financial crisis on the construction industry throughout Mexico, but also owing to the effects of U.S. tariffs on exports to the United States. Sales of cement, both domestic and export, were valued at $2.5 billion in 1995. The average consumer cement price in the country was about $126 per ton in 1994 and $106 in 1995. Owing to the devaluation of the peso, the production cost dropped from $41 per ton in 1994 to $29 per ton in 1995. In real terms, gross profit dropped from $85 to $77, or a net decrease of about $8. Even this was a cut of almost 10%, enough to force improvements in efficiency or, possibly, suspension of output.

Traditionally, Mexico has been a large exporter of cement to the United States; however, in 1990 the U.S. Government placed a countervailing duty of about 50% on Mexican cement exports into the United States. In 1992, a dispute settlement panel formed under the auspices of the General Agreement on Tariffs and Trade (GATT) declared that the compensatory duties levied by the United States on cement imported from Mexico were illegal according to the terms of the antidumping code of the GATT and recommended the rebate of deposits paid to that date. Since late 1992, the U.S. and Mexican Governments have negotiated to seek settlement of the dispute.

CEMEX was the leading producer of cement with about 75% of the national installed capacity of about 32 Mt, or 61% of the domestic market. CEMEX was the world's fourth largest cement producer in 1995 and operated 38 cement plants, 387 concrete plants, 27 maritime distribution terminals, and 76 distribution terminals in 22 nations.

In 1992, CEMEX acquired the two most important cement companies in Spain, Valenciana de Cementos and La Auxiliar de la Construccion, which could facilitate the replacement of Mexican exports by Spanish cement exports to the United States.

In 1994, CEMEX acquired two cement plants in the United States, one from Lafarge Coppee of France and the other from Holderbank Financiere Ltd. of Switzerland.

Other Mexican cement producers included Azul, Apasco, and nine other independent producers. Apasco, which was partially owned by Holderbank, was Mexico's second largest cement producer, with six plants, and undertook an expansion program in Ramos Arizpe, Coahuila.

A workers cooperative with two plants, Azul was Mexico's third largest cement producer. The Chihuahua group built a new plant in Zamlayuca, Chihuahua, and Cementos Moctezuma was expanding its Cuernavaca plant in Morelos. Market share for Mexico's leading cement companies in 1995 were approximately as follows: CEMEX, 61%; Apasco, 21%; Azul, 14%; Cementos Chihuahua, 3%; and others, 1%. Industry analysts expected Mexican cement capacity to increase from 45 Mt in 1995 to 48.6 Mt in 1996, based on expansion plans by CEMEX, Azul, and Apasco, as well as several small producers.

Fluorspar.—Mexican production of fluorspar increased an impressive 60% from 328,000 t in 1994 to 522,000 t in 1995. Of the 1995 total, 252,268 t was metallurgical-grade material and 270,390 t was acid-grade material. Mexico exports 60% to 75% of its fluorspar production, with the United States being the principal customer. Significant quantities of Mexican fluorspar were converted into hydrofluoric acid, most of which was imported also by the United States.

Mexico's most important fluorspar deposits were in the northern State of Coahuila; in Zaragoza municipality of San Luis Potosi; and in the Rio Verde area of Guanajuato. Many lead-zinc-silver veins in Mexico also contain fluorspar, to be recovered as a byproduct of polymetallic deposits in the Hidalgo del Parral, Santa Barbara, and the San Francisco del Oro region of Chihuahua. Mexico's largest fluorspar producer was Minera Las Cuevas near Zaragoza, which produced 13% of the world's fluorspar. Installed capacity was 320,000 tons per year (t/yr) of acid-grade concentrates and 200,000 t/yr of metallurgical grade. Las Cuevas

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fluorspar has a relatively high arsenic content that limited the use of the material in hydrofluoric acid plants and, thus, export sales. The firm was undergoing a 4-year expansion program to achieve total capacity of 750,000 t/yr of production. Minera Las Cuevas was 51% owned by Mexican nationals and 49% owned by Noranda Inc. of Canada.

Graphite.—Ranking as the largest graphite producer in the world after China, the Republic of Korea, and India, Mexico's production climbed from 30,900 t in 1994 to 34,400 t in 1995, about 98% of which was amorphous graphite.

The center of graphite production in Mexico was southeast of Hermosillo, Sonora, where amorphous graphite was mined from altered coal seams by the largest producers, Grafitera de Sonora and related companies. This group, Grafitos Mexicanos S.A., an affiliate of Cummings Moore Graphite Co. of the United States, accounted for about 78% of the graphite production of Sonora. Other companies producing amorphous graphite were Grafito Superior and Exploradora Sonorense de Grafito.

Grafito de Mexico produced flake (crystalline) graphite at Telixtlahuaca, Oaxaca. This company was privatized in 1989 by having been sold by the Government to Minerales No Metalicos Mexicanos, a mining company specializing in barite, bentonite, kaolin, and phosphate rock. Their plant had an annual capacity of about 2,000 t of flake graphite produced from 50,000 t of ore. Mexico exported one-half of its graphite production to the United States and has supplied about 30% of the U.S. demand for imported graphite in recent years.

Gypsum.—Mexican production of gypsum was about 4.92 Mt in 1995, down 11% from that of 1994. As with other so-called "construction" mineral commodities such as cement, the Mexican financial crisis and devaluation impacted the market for gypsum within the country by discouraging new construction. However, the Mexican gypsum industry retained its export markets as the third largest producer of gypsum in the Western Hemisphere, after the United States and Canada, and as the seventh largest producer in the world.

Most of the gypsum mined was used in the production of wallboard. Other uses were the manufacture of plaster, cement additives to adjust setting time, soil enhancers, glass additives, and as fillers in pharmaceuticals.

The largest gypsum producer in Mexico was Cia. Occidental Mexicana, S.A., a 49%-owned affiliate of Domtar Ltd. of Canada. This operation produced about 2.5 million tons per year (Mt/yr) of crude gypsum at facilities on San Marcos Island, about 40 kilometers (km) southeast of Santa Rosalia, Baja California Sur, in the Gulf of California. Most of this production was shipped to wallboard plants in the Western United States and Canada.

Other important producers included Yeso Mexicano, Yeso Panamericano, and Ciksa, affiliates of USG Inc. of the United States; Yeso Monterrey; and Yeso El Tigre. Yeso Mexicano's capacity was 280,000 t/yr of processed gypsum from its mine and plant at La Borreguita, San Luis Potosi. Yeso Monterrey had a processing capacity of 150,000 t/yr at its mine and plant in Mina, Nuevo Leon. Yeso El Tigre's capacity was 80,000 t/yr from its facilities at Lagunillas de Rayon, Puebla. Another company, Yesera Nazas S.A., had a production capacity of 60,000 t/yr from its plants in Matamoros, Coahuila, and Gómez Palacio, Durango. In 1990, Minera Caopas started production of gypsum at Santa Rosalia, Baja California Sur.

In addition to these producers, Mexican cement companies operated dedicated mines to meet their gypsum requirements, which amounted to approximately 1.44 Mt in 1994, the most recent data point. Gypsum was produced in 16 of Mexico's 31 States.

Sulfur.—PEMEX produced 867,000 t of sulfur as a byproduct of petroleum and natural gas operations in 1995. Sulfuric acid plants at Mexican base metal smelters produced 2.01 Mt of sulfuric acid in 1995, with an estimated sulfur content of 656,000 t.

Two companies with large Government equity participation, Azufrera Panamericana S.A. (APSA) and Compania Exploradora del Istmo S.A. (CEDI), produced 102,000 t of Frasch sulfur in 1993 until October of that year when their plants were closed, a conspicuous decrease of 86% from 1992 production of 710,000 t. The Frasch operations were closed as the result, and it was not clear when or if they would reopen. The Government of Mexico was expected to sell APSA as well as its two-thirds share of CEDI.

Mineral Fuels

Coal.—Production (run-of-mine) of steam and metallurgical coal increased about 3% from that of 1994 to 11.2 Mt, plus 1.85 Mt of washed metallurgical coal; this was much smaller than the 12% increase from 1993 to 1994.

The principal coal mining area of Mexico was the northern part of Coahuila, where MICARE operated. MICARE, the principal coal producer in Mexico, was sold to a joint venture between Grupo Acero del Norte (51%) and Mission Energy (49%) for $30 million plus the assumption of $100 million of debt. MICARE was undertaking an expansion program to increase its annual production to 9 Mt to supply new coal-fired plants being installed at Rio Escondido.

Other coal deposits were in Sonora and in Oaxaca. About 4 Mt/yr of steam coal has been mined by MICARE in Coahuila from the company's two open pit and two underground mines. Approximately 3 Mt of metallurgical coal was mined by Minerales Monclova S.A., and the remaining production was from about 10 small producers.

Natural Gas.—Mexico produced 38,879 Mm^3) of natural gas in 1995, up a little less than 4% from the 37,492 Mm^3 produced in the previous year. The Government of Mexico, in the form of PEMEX, owned all production. Most, but not all, of Mexico's output was associated gas, produced from oil reservoirs having either a gas cap or high saturation by lighter hydrocarbons that split off as gas at surface

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temperatures and pressures.

Gas production was consumed primarily within the country, but Mexico both exported and imported natural gas, with imports exceeding exports by about 4.3 Mm^3 per day. This difference was expected to shift in favor of net exports in 1996. Domestic production went partly into the petrochemical industry and otherwise into a growing system of domestic distribution pipelines. During 1995, the Government approved legislative changes to permit both domestic and foreign private-sector participation in natural gas storage, transport and distribution. Six consortia were competing for the right to distribute natual gas in Mexicali. Whichever wins will become the first licensed distributor under the new legal arrangements. Plans were for the next distribution license to be for the city of Chihuahua. PEMEX had 12,763 km of transmission pipelines, not counting gas distribution lines that it plans to divest as distribution areas are awarded.

Petroleum Crude.—The year 1995 saw Mexican crude production drop to 955.2 million barrels (Mbbl) from 980.0 Mbbl in 1994, representing a decrease of about 2.5%. Hurricanes Opal and Roxanne interfered with operations at PEMEX's maritime fields in the autumn of 1995, resulting in production losses of about 36 Mbbl of crude and 669 Mm^3 of natural gas. Prior to the incidence of these storms, PEMEX had been on-line to exceed production levels of 1994.

Overall, Mexico produced three grades of crude oil; namely, "Isthmus," "Maya," and "Olmeca." Olmeca was a very light crude running 39.3° API gravity with 0.8% sulfur by weight. Isthmus was a light crude at 33.6° API gravity with 1.3% sulfur, and Maya was a heavy crude running 22° API gravity with 3.3% sulfur. During 1995 the approximate mix of total production was Maya, 47%; Isthmus, 33%; and Olmeca, 20%. PEMEX calculated its average production costs at $2.52 per barrel (bbl), with maritime production at about $1.86 per bbl, which was in the range of much of the production of the Arabian Gulf. Highest costs were in the northern part of the country where, in line with south Texas economics, crude production cost $8.29 per bbl. Export prices of Mexican crude during 1995 varied from a minimum of $14.47per bbl (July) to a maximum of $17.35per bbl (April), averaging $15.70 per bbl.

As of 1995, Mexico ranked in sixth place in the world as a producer of crude oil and eighth in terms of reserves. In the Western Hemisphere, only the United States produced more oil than Mexico. Venezuela, the second leading producer of crude in Latin America, generated slightly less than 90% of Mexico's production. During the year, Mexico exported 1.306 million bbl per day of crude to about 23 countries, of which 84% went to the United States. Exports of crude in 1995 earned $7.48 billion for Mexico, an improvement of 13% over the value for 1994. In recent years PEMEX, via domestic and export sales, tax payments, and gas taxes, has provided about 30% of Mexico's total export earnings and has brought in about one-third of all public-sector income.

Reserves

The term "reserves" refers generally to mineral materials (ore) that can be mined, processed, and marketed to economic advantage.[4]

Yearly changes in estimation of reserves are, in simplest terms, the arithmetic result of additions to reserves, deletions of reserves, and production. Additions result from new discoveries, new technical information, and commodity price increases. Deletions are caused by increases in mining costs, decreases in market prices, and unforeseen requirements for additional capital for exploitation of otherwise favorable sites. Production is driven by the favorable balance between mining cost and return on investment, both of which may change continuously. Most mining operations aim at extracting the lowest grade that is profitable at prevailing prices for the product, thus not infrequently causing redefinition of the ore reserves. Some of the reserves in Mexican mines and deposits are contained in polymetallic deposits, necessitating close attention to market price and processing costs for two, or several, mineral commodities simultaneously to enable production as coproducts. *(See Table 3).* Mexican gold output has roughly doubled between 1993 and 1995, and exploration has turned conspicuously toward gold, but reserve estimates have been in a state of flux and are not shown in Table 3. No total value has yet been reported.

Infrastructure

Mexico had 26,445 km of railroads in 1993 and 245,433 km of roads. As part of the Toll Highway Program that began in 1989, more than 5,000 km of new highways were being constructed. In addition, private companies were constructing 33 toll highways, 1,600 km of roadways, and four bridges across the U.S. border with Mexico. The Government, while financing the expansion of 2,100 km of highways to four lanes, allowed the private sector to participate in such projects, including toll roads. The concession holder was allowed to charge tolls on projects developed until construction costs had been recovered and a reasonable profit made, at which time ownership of the highway would revert to the Government.

To streamline transportation of freight within Mexico, the Government, in 1990, modified regulations governing the trucking industry. After elimination of route control by private companies, Mexican carriers could move freight anywhere in the country. In addition, under NAFTA, U.S. and Canadian trucking lines, after a 3-year waiting period, would be able to avoid transshipment delays at the border by transporting freight directly across national boundaries to destinations in Sonora, Chihuahua, Nuevo Leon, and Coahuila. Mexican carriers had reciprocal rights to operate in Arizona, California, New Mexico, and Texas.

The country had 21 ports and 2,900 km of navigable rivers and coastal canals. Of the country's 64 ships in the merchant marine, at least 44 were available for the transportation of

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mineral products. Most ore and metallurgical products within Mexico were transported by truck. Railways declined in importance during the 1980's, as the volume of freight and passenger transport dropped by more than 25% owing to increasingly poor and unreliable service. Railroads accounted for only 9% of Mexico's total freight traffic in 1991, and were used mainly for bulk items such as coal, coke and iron ore. Gray portland cement, for example, was transported by roads (61%), by railroads (26%), and by ship (13%). About 65% of the cement sold in bulk.

U.S. railroads, such as Burlington Northern, Santa Fe, Southern Pacific, Tex-Mex Railroad, and Union Pacific, were working with the Mexican railroad, Ferrocarriles Nacionales de Mexico (FNM), to transport freight inside Mexico. Union Pacific was investing in the Huehuetoca rail distribution center and in the Port Laredo facility. Union Pacific Technologies has sold its Transportation Control System, designed to manage yard operations and train scheduling, to FNM. Southern Pacific and FNM offered double-stack container service to Mexico City. Southern Pacific also was investing in Ferropuertos, a series of intermodal distribution centers in Celaya, Monterrey, Torreon, and north of Los Mochis. The facilities would handle such shipments as consumer goods, grains, and minerals in bulk. Finally, FNM also was cooperating with Southern Pacific, Tex-Mex, and Union Pacific on the integration of shipping rates and training of Mexico's railroad employees.

Hydrocarbon output continued to dominate Mexico's energy sector. Crude oil and natural gas generally represented about 90% of all energy produced. The remaining 10% of primary energy production typically was from wood and sugar cane (4.3%), hydroelectric sources (3.1%), coal (1.5%), geothermal wells (0.7%), and nuclear energy (0.5%) according to an analysis (rounded) of 1992.

Crude oil and natural gas were transported mainly through pipelines within Mexico. Of the country's nine refineries, eight received crude oil by pipeline.

Outlook

After a generally strong showing in 1995, Mexico's production of all major minerals was expected to expand further. Some sectors of the industry, particularly iron and steel, demonstrated flexibility amidst the sharp decline in domestic consumption by shifting to higher output and boosting of exports in the space of the single year 1995. Other sectors, such as copper, lead-zinc, and silver, increased their production in the knowledge that the markets were ready and able to accommodate their offerings. PEMEX was able to sell all of the petroleum crude and natural gas it could produce. Market pricing in hard currencies, not only the dollar but the yen, the pound, and the deutsche mark, presented attractive export targets for mineral commodities whose production costs were denominated in the recently devalued pesos.

Certain dislocations in metallic mineral commodity markets of the late 1980's and early 1990's, resulting in world price weaknesses, seem to have been overcome to the extent that prices have firmed and climbed, providing an incentive for production and expansion. World petroleum prices have risen also through the past year or so; with no warrant of permanence, they have nonetheless brought enhanced income to PEMEX and hence Mexico itself.

The future holds great promise for the virtually explosive expansion of interest in exploration, development, and mining in the gold sector, where production increased by one-third in 1995 alone. More than 200 companies, many from the United States and Canada, have been involved in mineral exploration for gold in Sonora, Durango, and Baja California. Foreseeably, many of these companies will succeed and become permanently involved in Mexico, bringing new capital and technology.

The downside of Mexico's mineral industry has been the recent sharp contraction through 1995 in demand for construction materials such as cement, gypsum, and steel for domestic use. The outlook here, critical to a large proportion of Mexican wage-earners, will fluctuate as a function of the recovery of the peso. Some direct international financial support has been extended that will help stabilize the currency. The prospect of continued investment of foreign capital in Mexico's mineral industry, and other sectors, will help to restore confidence and solvency within the economy.

Mexico has been viewed by many companies as not only presenting fewer obstacles to mining but also as being less of a political risk for mining investments than Canada, the United States, and some other Latin American countries. Consequently, Mexico was expected to attract more foreign capital, and its mining industry should continue to increase in significance. Total mining investment in the next 5 years had been estimated by the Mexican Mining Chamber to be on the order of $5 billion.

Toward the end of the century, NAFTA may well benefit the overall economy; even so, The Mining Law (1992) and new foreign investment law were expected to play significant roles in attracting foreign capital, not only from North American companies but, increasingly, from those in Europe and Asia.

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[1]Much of the general and commodity information in this report was provided by Mr. Steve Ordal, Regional Resources Officer, and Ing. Javier Moya R., Minerals Specialist with the Economic Section of the Embassy of the United States in Mexico City. Mr. Moya's efforts have been invaluable in providing a comprehensive, detailed, and timely report. Ing. Moya not only compiles the annual Minerals Questionnaire, but he also is the author of the comprehensive annual Mexico's Minerals Outlook Report used extensively as source material for this report. Any datum or statistic in the text not referenced elsewhere may be assumed to be from either the Minerals Outlook Report or the related series of separate, preliminary, topical reports prepared by Ing. Moya.

[2]Where necessary, values have been converted from Mexican pesos (Mex$) to U.S. dollars at the rate of Mex$6.4=US$1.00, the average rate of exchange for 1995.

[3]U.S.Geological Survey. Circular 831—Principles of a Resource/Reserve Classification for Minerals.

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TABLE 1
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1991	1992	1993	1994	1995
METALS						
Aluminum, metal:						
Primary		50,800	24,800	25,800	--	10,413
Secondary		54,200	59,500	69,900	145,216 r/	128,618
Antimony:						
Mine output, Sb content		1,470	1,200 e/	1,470	1,800 e/	1,820 e/
Metal 4/		1,280	1,060	1,490	1,760	1,783
Arsenic 5/		4,920	4,290	4,450	4,440	3,620
Bismuth:						
Mine output, Bi content 6/		651	807	908	1,050	995
Metal, refined e/		500	550	650	836 7/	924 7/
Cadmium:						
Mine output, Cd content		3,100 e/	3,250 e/	3,320	2,580	1,385
Metal, refined		688	602	797	646	689
Copper:						
Mine output, Cu content 8/						
By concentration		260,400	251,100 r/	277,000	279,700 r/	304,300
Leaching (electrowon)		32,100	27,900	24,100 r/	25,800 r/	27,600
Total		292,500	279,000 r/	301,100	305,500 r/	331,900
Metal:						
Anode and blister		183,000	227,000 r/	94,000 r/	277,000 r/	298,000
Refined:						
Primary 9/		106,000	111,000	93,800 r/	104,300 r/	103,100
Secondary		53,000	80,500	77,200	92,700 r/	98,800
Total		159,000	191,500 r/	171,000 r/	197,000 r/	201,900
Gold:						
Mine output, Au content	kilograms	10,100	9,890	9,770	14,642 r/	20,292
Metal, refined	do.	5,020	5,740	6,090	6,450	8,355
Iron and steel:						
Iron ore, mine output:						
Gross weight	thousand tons	9,994 r/	10,964 r/	11,435 r/	8,538 r/	8,523 e/
Fe content	do.	6,596 r/	7,236	7,547	5,516 r/	5,625
Metal:						
Pig iron	do.	2,960	3,400	3,420	3,401 r/	4,142
Sponge iron	do.	2,460	2,390	2,740	3,220	3,691
Total	do.	5,420	5,790	6,160	6,621 r/	7,833
Ferroalloys:						
Ferromanganese	do.	98	79	70 e/	117	109
Silicomanganese	do.	51	51	55 e/	72	77
Ferrosilicon	do.	6	5	(10/)	--	--
Ferrochromium	do.	(10/)	(10/)	--	--	--
Other	do.	(10/)	(10/)	(10/)	--	--
Total	do.	155	135	126	189	186
Crude steel	do.	7,960	8,460	9,190	10,260 r/	12,128
Rolled products 11/	do.	6,250	6,240	6,660	7,583 r/	8,478
Lead:						
Mine output, Pb content		168,000	170,000	149,000	170,322	164,348
Metal:						
Smelter:						
Primary		163,000	163,000	172,000	152,502 r/	160,322
Secondary (refined) e/		10,000	10,000	10,000	10,000	10,000
Total e/		173,000	173,000	182,000	164,000	170,322
Refined:						
Primary 12/		152,000	167,000	178,000	162,000	164,348
Secondary e/		10,000	10,000	10,000	10,000	10,000
Total e/		162,000	177,000	188,000	172,000	174,348 7/

See footnotes at end of table.

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TABLE 1--Continued
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1991	1992	1993	1994	1995
METALS--Continued						
Lead--Continued:						
Metal--Continued:						
Refined--Continued:						
Primary 12/		152,000	167,000	178,000	162,000	164,348
Secondary e/		10,000	10,000	10,000	10,000	10,000
Total e/		162,000	177,000	188,000	172,000 r/	174,348 7/
Manganese ore: 13/						
Gross weight		254,000	407,000	363,000	307,000	472,200
Mn content e/		92,800	153,000	135,000	112,000	174,200
Mercury, mine output, Hg content		340	21	12	12	15 e/
Molybdenum, mine output, Mo content		1,720	1,460	1,710	2,610	3,810
Selenium, mine output, Se content	kilograms	2,800	400	--	--	--
Silver:						
Mine output, Ag content	do.	2,300,000	2,100,000	2,110,000	2,214,638 r/	2,496,000
Metallurgical products, Ag content:						
In copper bars	do.	210,000	286,000	409,000	470,000	435,906
Mixed gold and silver bars	do.	72,600	103,000	109,000	124,000	169,744
Metal, refined, primary	do.	1,780,000	1,770,000	1,770,000	1,700,000	1,781,111
Other	do.	73,200	111,000	78,100	123,000	106,489
Tin:						
Mine output, Sn content		12	1	3	3	1
Metal, smelter, primary		2,260	2,590	1,640	1,640	770
Tungsten, mine output, W content		194	162	--	--	--
Zinc:						
Mine output, Zn content		317,000	294,000	369,000	361,689 r/	363,658
Metal, refined, primary		189,000	152,000	210,000	209,200	222,748
INDUSTRIAL MINERALS						
Abrasives, natural e/ 14/		25,000	25,000	25,000	25,000	25,000
Barite		192,000	188,000	136,000	86,605	248,367
Cement, hydraulic	thousand tons	25,100	26,880	27,120	29,700	23,971
Clays:						
Bentonite		145,000	136,000	94,600	92,476 r/	92,432
Common		3,920,000	4,170,000	4,420,000	4,553,635 r/	4,894,689
Fuller's earth		41,100	41,100	36,100	21,377 r/	21,377
Kaolin		167,000	144,000	216,000	193,034 r/	188,640
Diatomite		46,000	46,400	46,100	52,100 r/	55,226
Feldspar		152,000	160,000	124,000	133,441	121,779
Fluorspar:						
Acid-grade	thousand tons	277	189	187	129 r/	270
Metallurgical-grade	do.	90	95	93	103	252
Submetallurgical-grade e/	do.	3	3	3	3	--
Total	do.	370	287	283	235 r/	522
Graphite, natural:						
Amorphous		35,300	30,500	42,600	29,903	32,938
Crystalline		1,940	985	960	960 e/	1,450
Gypsum and anhydrite, crude (yeso)		4,770,000	5,160,000	5,340,000	5,530,000	4,917,840
Lime, hydrated and quicklime e/	thousand tons	6,500	6,500	6,500	6,500	6,500
Magnesium compounds:						
Magnesite		600 e/	--	1,530	1,120	1,200 e/
Magnesia 15/		112,000	125,000	125,000 e/	125,000 e/	125,000 e/
Mica, all grades		5,590	5,870	6,440	5,753 r/	5,142
Nitrogen: N content of ammonia		2,220,000	2,200,000	1,760,000	2,030,000	1,992,000
Perlite		48,900	42,600	34,600	31,918 r/	29,471
Phosphate rock 16/		596,000	515,000	237,000	546,857 r/	622,354
Salt, all types	thousand tons	7,530	7,400	7,490	7,460	7,670
Sodium compounds, n.e.s.:						
Carbonate (soda ash): e/ 17/						
Natural		190,000	160,000	160,000	160,000	160,000
Synthetic		259,000	280,000	280,000	280,000	270,000
Sulfate, natural (bloedite) 18/		518,000	534,000	500,000 e/	527,228	500,000 e/
Stone, sand and gravel:						
Calcite, common		458,000	476,000	423,000	389,749 r/	359,221
Dolomite		471,000	466,000	545,000	588,000	550,000 e/
Limestone 19/						
Marble		750,000	860,000	987,000	1,130,000	898,990
Quartz, quartzite, glass sand (silica)		1,200,000	1,130,000	1,310,000	1,359,987	1,292,265

See footnotes at end of table.

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TABLE 1--Continued
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1991	1992	1993	1994	1995
INDUSTRIAL MINERALS						
Sand	thousand cubic meters	44,000	46,300	47,600	50,982 r/	54,592
Gravel	do.	39,700	42,600	43,700	44,899	50,536
Strontium minerals, celestite		62,200	61,100	71,900	111,000	100,000 e/
Sulfur, elemental:						
Frasch process	thousand tons	1,040	710	102	--	--
Byproduct:						
Of metallurgy e/	do.	280	817	730	2,014 7/	2,010 7/
Of petroleum and natural gas	do.	754	775	804	877	867
Other e/	do.	20 7/	--	30	30	25
Total e/	do.	2,094	2,302	1,666	2,921	2,902
Talc		11,900	19,600	14,400	14,900 r/	15,443
Vermiculite		117	125	134	300	300
Wollastonite		13,900	27,400	35,800	29,000 r/	29,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Run-of-mine:						
Metallurgical	thousand tons	4,540	3,640	4,500	4,632	4,036
Steam	do.	4,870	5,060	5,720	6,311 r/	7,197
Total	do.	9,410	8,700	10,220	10,943 r/	11,233
Washed metallurgical coal	do.	2,210	1,610	1,710 e/	1,800 e/	1,850 e/
Coke: 20/						
Metallurgical	do.	2,010	1,890	1,890	1,933	2,097
Imperial	do.	3	2	3	3	--
Breeze	do.	98	144	49	49	51
Total	do.	2,111	2,036 r/	1,942	1,985 r/	2,148
Gas, natural:						
Gross	million cubic meters	37,600	37,100	37,000	37,492	38,879
Marketed	do.	33,700	32,700	35,700	36,000 e/	36,000 e/
Petroleum:						
Crude	ousand 42-gallon barrels	977,000	974,000	976,000	980,025	955,205
Condensate	do.	1,440	1,640	1,500 e/	1,500 e/	1,500 e/
Total	do.	978,440	975,640	977,500	981,525	956,705
Refinery products:						
Liquefied petroleum gas	do.	25,200	20,100	21,500	24,100	22,265
Motor gasoline	do.	153,000	148,000	152,000	157,000	154,395
Jet fuel	do.	22,600	23,700	26,300	27,000	25,550
Kerosene	do.	3,650	4,020	3,650	3,290	1,825
Distillate fuel oil (diesel)	do.	101,000	101,000	97,500	104,000	92,710
Lubricants	do.	2,920	2,920	2,560	2,560	2,555
Residual fuel oil	do.	152,000	157,000	162,000	156,000	151,840
Asphalt	do.	7,670	8,400	8,760	11,700	10,950
Unspecified and refinery fuel and loss	do.	19,000	19,900	20,700	24,400	24,090
Total	do.	487,040	485,040	494,970	510,050	486,180

e/ Estimated. r/ Revised.

1/ Data published for 1990 through 1994 in the preceding year were rounded by the U.S. Bureau of Mines to three significant digits. Where possible, data in the present table have been unrounded to their original state.

2/ Table includes data available through Aug. 31, 1996.

3/ In addition to the commodities listed, additional types of crude construction materials are produced, but output is not reported; available information is inadequate to make estimates of output levels.

4/ Sb content of antimonial lead and impure bars plus refined metals.

5/ Arsenic content of white and black (impure) arsenic trioxide.

6/ Refined metal plus Bi content of impure smelter products.

7/ Reported figure.

8/ Series reported by Camara Minera de Mexico (CAMIMEX). Tonnages reflect a 2.5% metal loss in smelter.

9/ Includes cathode copper from the Cía. Mexicana de Cananea S.A. de C.V. electrowinning plant, in metric tons, as follows: 1991--32,000; 1992--27,900; 1993--24,100 (revised); 1994--25,800 (revised); and 1995--27,600.

10/ Less than 1/2 unit.

11/ Includes flat, nonflat, and seamless pipe steel products.

12/ Pb content of antimonial lead and impure bars plus primary refined metals.

13/ Mostly oxide nodules; includes smaller quantities of direct-shipping carbonates and oxide ores for metallurgical and battery applications.

14/ Based on exports comprising mostly pumice stone and emery (a granular, impure variety of corundum).

15/ Reported by Industrias Penoles S.A. de C.V. as the only major producer.

16/ Includes only output used to manufacture fertilizers.

17/ Total sodium carbonate reported by Asociación Nacional de la Industria Química.

18/ Series reflects output reported by Industrias Peñoles plus an additional 22,000 tons estimated production by Sulfato de Viesca.

19/ Excludes that for cement production.

20/ Includes coke made from imported metallurgical coal.

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TABLE 2
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Aluminum		Aluminio S.A. (Nacobre, 77.8%; Carso Group, 20%)	Smelter at Veracruz, Ver.	94.
Antimony		Cia. Minera y Refinadora Mexicana S.A. (private Mexican, 51%; Cookson Ltd., 49%)	San Jose Mine, Catorce, S.L.P.	365.
Barite		Barita de Sonora S.A. (Grupo Acerero del Norte S.A. de C.V., 100%)	Mazatan, Son.	264.
Do.		Minera Capela S.A. (Penoles, 100%)	La Minita Mine, Coalcoman, Mich.	150. 2/
Do.		Minerales y Arcillas S.A. de C.V. (private Mexican, 100%)	Galeana, N.L.	108.
Do.		do.	Apodaca, N.L.	60.
Do.		Barita de Santa Rosa S.A. de C.V. (private Mexican, 100%)	Muzquiz, Coah.	256.
Cement		Cementos Mexicanos S.A. de C.V. (private Mexican, 100%	Monterrey, N.L.; Torreon, Coah.; Huichiapan, Hgo.; Valles, S.L.P.	8,970 (Monterrey group).
Do.		Cementos Anahuac S.A. (Cementos Mexicanos, 100%)	Leon, Gto.; Merida, Yuc.; Tlanepantla, Mex.; Tamuin, S.L.P.	6,970 (Maya group).
Do.		Cementos Tolteca S.A. (Cementos Mexicanos, 100%)	Atotonilco, Hgo.; Zapotiltic, Jal.; Tula, Hgo.; Hornillos, Sin.; Hermosillo, Son	7,150 (Tolteca group).
Do.		Cementos Guadalajara S.A. (Cementos Mexicanos, 100%)	Ensenada, B.C.N.; Guadalajara, Jal.; Hermosillo, Son.; Hidalgo, N.L.	4,445 (Cegusa group).
Do.		Cementos Apasco S.A. de C.V. (Holderbank, 49%)	Apasco, Hgo.; Ramos Arizpe, Coah.; Macuspana, Tab.; Caleras, Col.; Orizaba, Ver.; Acapulco, Gro.	9,500.
Do.		Sociedad Cooperativa La Cruz Azul (private Mexican, 100%)	Jasso, Hgo.; La Cruz Azul, Oax.	4,600.
Do.		Cementos Chihuahua S.A. de C.V. (private Mexicanos, 100%)	Chihuahua, Chih.; Cuidad Juarez, Chih.	1,160.
Coal		Minerales de Monclova S.A. (Altos Hornos de Mexico, S.A., 100%)	Mimosa, Palau mines, Muzquiz washing plant at Palau, Coah., and Coking plant at Monclova, Coah.	3,000
Do.		Carbonifera de San Patricio S.A. de C.V. (private Mexicanos, 100%)	Progresso, Coah.	1,314.
Do.		Industrial Minera Mexico S.A. de C.V. C.V. 3/ (Grupo Mexico, 74%; Asarco Inc. of U.S. and others, 26%)	Nueva Rosita, Coah.	1,500.
Do.		Minera Carbonifera Rio Escondido S.A. (MICARE) (Grupo Acerero del Norte, 51%; Mission Energy, 49%)	MinaI, Mina II, and Tajo I at Nava and Piedras Negras, Coah.	4,000.
Copper		Mexicana de Cobre S.A. (Mexico Desarollo Industrial Minero, 96.4%) 3/	La Caridad Mine and smelter at Nacozari de Garcia, Son.	180 smelter, 16 leaching.
Do.		Mexicana de Cananea S.A. (Mexicana de Cobre, S.A., 76.1%; ACEC Union Miniere, S.A. of Belgium, 21.2%; Workers Union, 2.7%)	Mine and smelter at Cananea, Son.	170 smelter, 20 leaching.
Do.		Minera Maria S.A. de C.V. (Empresas Frisco, 51%; Cominco Resources International, 49%)	Cananea District, Son.	18.
Ferroalloys		Cia. Minera Autlan S.A. (Grupo Ferrominero, 54%; Minas de Basis S.A. de C.V., 32%; Broken Hill Property Co. Ltd. of Australia, 14%)	Plant in Tamos, Ver. Plant in Teziutlan, Pue.	140. 38.
Fluorspar		Cia. Minera Las Cuevas S.A. (Grupo Industrial Camesa S.A. de C.V.) 4/	Salitera (Zaragoza), S.L.P.	520.
Do.		Fluorita de Mexico S.A. de C.V. (private Mexican, 51%; AIMCOR, 49%)	Mines at La Encantada range and plant at Muzquiz, Coah.	500.
Gold	kilograms	Cia. Fresnillo S.A. (Industrias Penoles, S.A. de C.V., 60%; AMAX, 40%)	Fresnillo Mine, Zac.	1,866.
Do.	do.	Minas de San Luis S.A. (Industriales Luismin, 100%)	Tayoltita, Dgo.	1,400.
Do.	do.	Cia. Minera de Santa Gertrudis (Grupo Ariztegui, 51%; Phelps Dodge, 49%)	Santa Gertrudis Mine, Son.	1,600.
Do.	do.	Exploraciones El Dorado S.A. de C.V. (70%), Minerales Sotula (70%)	La Colorada Mine, Son.	800.
Do.	do.	Minera Hecla (Hecla Mining Co. of U.S., 100%)	La Choya Mine, Son.	2,000.
Do.	do.	Cia. Minera las Torres S.A. de C.V. (100% Industrias Penoles)	Guanajuato, Gto.	730.

See footnotes at end of table.

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TABLE 2–Continued
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metrictons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Gold–Continued	kilograms	Cia. Minera El Cubo S.A. de C.V. (private Mexican, 100%)	do.	128.
Do.	do.	Sociedad Cooperativa Minero Metalurgica Santa Fe de Guanajuato (private Mexican, 100%)	do.	438.
Graphite		Grafitos Mexicanos S.A. (Cummings Moore Graphite Co. of the U.S., 25%; private Mexican, 75%)	Lourdes and San Francisco Mines, Son.	60.
Gypsum		Cia. Occidental Mexciana S.A. (private Mexican, 51%; Domtar, Ltd. of Canada, 49%)	Santa Rosalia on San Marcos Island, B.C.S.	2,500
Iron ore		(Grupo Acerero del Norte, 29%; Caribbean ISPAT, 29%; Hylsa de Mexico S.A., 42%)	Pena Colorada Mine and pellet plant near Manzanillo, Col.	3,000.
Do.		Siderurgica Lazaro Cardenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Ferrotepec, Volcan, and Mango deposits in Las Truchas project area and pellet plant, Mich.	1,900.
Lead and zinc		Mexico Desarollo Industrial Minero S.A. (Grupo Mexico, 74%; Asarco Inc. of U.S. and others, 26%)	Charcas, S.L.P.; San Martin, Zac.; Santa Eulalia, Chih.; Taxco, Gro.; Rosario, Sin.; lead smelter at Chih.; lead refinery at Monterrey, N.L.; zinc refinery at S.L.P.	70 (lead), 150 (zinc).
Do.		Industrias Penoles S.A. de C.V. (private Mexican, 97%; U.S. private, 3%)	Mines at La Encantada, Coah.; Fresnillo, Zac.; Naica, Chih.; Bismark, Son. Rey de Plata, Gro. (Penoles, 60%; Outokump, 40%); Metallurgical complex at Torreon, Coah., with silver, lead, and zinc smelter and/or refineries operated by Met-MexPenoles (Penoles, 100%)	50 (lead), 60 (zinc).
Do.		Minera San Francisco del ro S.A. de C.V. (Frisco, S.A. de C.V., 100%)	San Francisco del Oro, Chih.	15 (lead). 21 (zinc).
Do.		Minera Real de Angeles S.A. de C.V. (Frisco, S.A. de C.V., 100%)	Noria de Angeles, Zac.	45 (lead). 47 (zinc).
Manganese		Cia. Minera Autllan S.A. (Grupo Ferrominero, 54%; Minas de Basis, S.A. de C.V., 32%; Broken Hill Property Co. Ltd. of Australia, 14%)	Molango Mine, Hgo. Nonoalco Mine, Hgo. Gomez Palacio, Hgo.	460. 26. 35.
Molybdenum		Mexicana de Cobre S.A. (Mexico Desarollo Industrial Minero, 96.4%)	La Caridad Mine, Molybdenum plant, Son.	6.
Petroleum	thousand 42-gallon barrels per day	Petroleos Mexicanos (PEMEX) (Government, 100%)	Comalcalco, Poza Rica, Ver., and Gulf of Campeche, Cam. districts	3,500. 5/
Salt		Exportadora de Sal S.A. (ESSA) (Fideicomiso de Fomento Minero, 51%; Mitsubishi Corp., 49%)	Solar salt complex at Guerrero Negro, B.C.S.	6,000.
Silver	kilograms	Industrias Penoles S.A. de C.V. (private Mexican, 97%; U.S. private, 3%) 6/	Naica, Chih.; Fresnillo, Zac.; Las Torres, Gto.; Cuale, Jal.; La Negra, Qro.; La Encantada, Coah.; La Minita, Mich.	654,000.
Do.	do.	Mexico Desarollo Industrial Minero S.A. (Grupo Mexico, 74%; Asarco Inc. of U.S. and others, 26%)	San Martin Mine, Sombrerete, Zac.; Taxco, Gro.; Charcas, S.L.P.; Santa Eulalia, Chih.; Refiney at Monterrey, N.L.	467,000.
Do.	do.	Minera Real de Angeles S.A. de C.V. (Frisco S.A. de C.V., 100%)	Open pit mine and concentrator at Noria de Angeles, Zac.	924,000.
Sodium carbonate		Sosa Texcoco S.A. (private Mexican, 100%)	Lake Texcoco, Mex., from subsurface brines	200.
Sodium sulfate		Quimica Magna, S.A. de C.V. (Industria Penoles S.A. de C.V., 100%)	Subsurface brines at Laguna del Rey, Coah.	350.
Steel		Altos Hornos de Mexico S.A. (AHMSA), Grupo Acereros de Norte (GAN)	Steelworks at Monclova, Coah. (Iron ore from Pena Colorada Mine in Col.)	3,900.
Do.		Hylsa de Mexico S.A. (Grupo Industrial ALFA, 100%)	Direct-reduction units at Monterrey, N.L., and Puebla, Pue., (Iron ore from Cerro Nahuatl Mine in Col.)	1,800.
Do.		Siderurgica Lazaro Cardenas-Las Truchas S.A. S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Port of Lazaro Cardenas, Mich.	1,300.

See footnotes at end of table.

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TABLE 2--Continued
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Steel--Continued:	Siderurgica del Balsas S.A. (SIBALSA) (Caribbean ISPAT, 100%)	SICARTSA II Plant Facilities at Lazaro Cardenas, Mich., plus 29% share in the Pena Colorada Mine, Col.	2,000 (steel), 1,500 (steel plate).
	Azufrera Panamericana S.A. (APSA) (Fideicomiso de Fomento Minero, 96%; private, 4%)	Coachapa, Patapa, Jaltipan, Ver.	1,230. 7/
Do.	Cia. Exploradora del Istmo S.A. (Government, 64%; Texasgulf, Inc., 34%; private, 2%)	Texistepec, Ver.	750. 7/
Tin 8/	Metales Potosi S.A. (private Mexican, 100%)	San Luis Potosi, S.L.P.	6.4.
Do.	Estano Electro S.A. (private Mexican, 100%)	Tlalnepantla, Mexico, D.F.	1.3.
Do.	Fundidora de Estano S.A. (private Mexican, 100%)	San Luis Potosi, S.L.P.	1.2.

1/ State abbreviations: Baja California Norte (B.C.N.), Baja California Sur (B.C.S.), Campeche (Cam.), Chiapas (Chia.), Chihuahua (Chih.), Coahuila (Coah.), Colima (Col.), Distrito Federal (D.F.), Durango (Dgo.), Guanajuato (Gto.), Guerrero (Gro.), Hidalgo (Hgo.), Jalisco (Jal.), Mexico (Mex.), Michoacan Mich.), Nuevo Leon (N.L.) Oaxaca (Oax.), Puelba (Pue.), Queretaro (Qro.), San Luis Potosi (S.L.P.), Sinaloa (Sin.), Sonora (Son.), Tabasco (Tab.), Veracruz (Ver.), Yucatan (Yuc.), and Zacatecas (Zac.)
2/ Operation was shut down in 1989.
3/ In Aug. 1994, Mexico Desarrollo Industrial Minero and Grupo Industrial Minera Mexico were reorganized to form Grupo Mexico.
4/ Grupo Industrial Camesa S.A. de C.V. is owned by private Mexican (51%) and Noranda, Inc. of Canada (49%).
5/ PEMEX operates nine refineries with an installed capacity of 1.68 million barrels per day.
6/ Includes capacity from Cia. Fresnillo S.A. de C.V.
7/ Operation was shut down in 1993.
8/ Smelter output from mostly imported concentrates.

TABLE 3
MEXICO: RESERVES OF SELECTED MINERAL COMMODITIES FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity 1/		Reserves
Antimony		180
Barite		7,000
Bismuth	metric tons	10,000
Cadium	do.	35,000
Copper		14,000
Fluorspar 2/		19,000
Gas, natural 3/	billion cubic meters	1,840
Graphite, natural		3,100
Lead		1,000
Manganese		4,000
Mercury	metric tons	5,000
Molybdeum	do.	90
Petroleum, crude 3/	million 42-gallon barrels	42,146
Selenium	metric tons	4,000
Silver	do.	37,000
Sodium carbonate, natural		200,000
Sodium sulfate, natural		170,000
Sulfur 4.		75,000
Zinc		6,000

1. All metals expressed in metal content.
2. Measured as 100% calcium fluoride.
3. Yearend 1995. Source: Petroleos Mexicanos Statistical Yearbook 1995.
4. Sulfur in all forms.

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THE MINERAL INDUSTRY OF

NICARAGUA

By David B. Doan

Mineral production in Nicaragua accounted for less than 1% of the country's gross domestic product in spite of its history as the world's 14th or 15th largest gold producer in the 1940's and 1950's. The Nicaraguan Mining Corp., or Corporación Nicaraguense de Minas (INMINE), was established in 1988 to organize, administer, direct, and promote the country's mining industry as well as to control permits and licenses for mining concessions. Since 1990, the Government of Nicaragua has devoted increasing attention to modernizing its legal framework. A new mining law was being drafted that would bring both the awarding of concessions and the tax structure into closer accord with common practice in the rest of the world. Besides encouraging private investment, the law would be updated and simplified in the context of current mining technology. The country had no environmental regulations, but environmental remediation was a growing priority, given that Nicaragua had a poor history of responsibility by past mining operations.

Nicaragua operated several small metal mines, producing gold and silver, mostly in sparsely populated areas in the northwest. Most bentonite, gold, gypsum, lime, and silver were exported. Other industrial minerals, such as cement, sand and gravel, and salt were consumed domestically. *(See table 1.)* The Central Bank of Nicaragua controlled the export of gold and silver. INMINE controlled most of the country's mineral exploration and production operations. Corporaciones Nacionales del Sector Publico's role included returning firms to former owners, selling them to private investors, and closing unprofitable companies.

Nicaragua's largest producer of gold was the El Limon Mine, operated by INMINE's Empresa Francisco Meza Rojas, including two open pits with an adjacent cyanide processing plant and the underground Talavera Mine, 4 kilometers (km) to the west. The mill was expanded to treat 1,000 metric tons per day (t/d).

Following 2 years of negotiations, Canada-based Greenstone Resources Ltd. acquired, in 1994, a 75% interest in the La Libertad gold mine from the Nicaraguan Government. The 120-square-kilometer concession surrounded a small open pit mine. Upon completion of nearly 6,000 meters of reverse-circulation drilling, Greenstone projected reserves of 9.3 million tons containing 2.12 grams per ton of gold at La Libertad.[1] After producing about 155 kilograms in 1994, increases were expected as part of a large-scale mine expansion.

Cement was produced by the State-owned Compania Nacional Productora de Cemento. Empresa Nicaraguense de Minerales No Metalicos controlled several of the state's industrial mineral companies, including bentonite (Empresa Rotowa S.A.), gypsum (Yesera Centroamericana S.A.), and limestone (Empresa Piedra Cal S.A. and Empresa Cal El Pueblo). The Inversiones Mineras A.S. (IMISA) functioned as a holding company to promote and expand its affiliated production companies. IMISA incorporated Arenas S.A. (sand and gravel), Canteras S.A. (dimension stone), and Calizas S.A. (limestone). Salt was produced by private companies. Nicaragua relied on imports for mineral fuel, especially crude from Venezuela. Esso Standard Oil S.A. Ltd. supplied most of the country's petroleum products. Geothermal energy was an important energy resource, having an estimated potential of 1,200 megawatts (MW). The 70 MW Momotombo geothermal plant on the north shore of Lake Managua accounted for 20% of Nicaragua's installed capacity.

Mining in Nicaragua had great potential for expansion; the Government planned to revive the industry with financial and technical aid from abroad.

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[1]Greenstone Resources Ltd. (Toronto): Annual Report, 1995.

Major Sources of Information

Banco Central de Nicaragua
Km. 7 Carretera Sur
Managua, Nicaragua
Telephone: (505)2-650460 or 2-652051
Corporacion Nicaragüense de Minas (INMINE)
Apartado Postal No. 195
Managua, Nicaragua
Telephone: (505)2-52071
Fax: (505)2-51043
Corporaciones Nacionales del Sector Publico (CORNAP)
Km. 7-1/2 Carretera Norte
Managua, Nicaragua
Telephone: (505)2-31289
Fax: (505)2-31193

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Instituto Nicaraguense de Energia
Contiguo a plaza 19 de Julio
Managua, Nicaragua
Telephone: (505)2-674103 or 2-672688
Fax: (505)2-672686 or 2-674377

Instituto Nicaraguense de Recursos Naturales del Ambiente
Km. 12 1/2 Carretera Norte
Managua, Nicaragua
Telephone: (505)2-631273 or 2-631848

Inversiones Mineras, S.A.
Cine Cabrera, 4c.al
Sur. 1/2 Oeste
Managua, Nicaragua
Telephone: (505)2-668602

Ministerio de Economic y Desarolla
Apartado Postal No. 8
Frente al Camino de Oriente
Managua, Nicaragua
Telephone: (505)2-670051
Fax: (505)2-670095

Nicaraguan Mining Chamber
Del Porton El Retiro, 2C. Al Lago
Managua, Nicaragua
Telephone: (505)2-669623
Fax: (505)2-669627

Major Publications

Banco Central de Nicaragua, Gerencia de Estudios Economicos: Indicadores de Actividad Economica, 1993, Managua, Nicaragua, annual.

Corporacion Nicaraguense de Minas (INMINE): Balance Anual, 1993, Managua, Nicaragua, annual.

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Instituto Nacional de Estadisticas y Censos: Annuario Estadisticoo de Nicaragua, Managua, Nicaragua, annual.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Nicaragua Export Directory, 1993-94, Managua, Nicaragua, annual.

U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1
NICARAGUA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodities 3/		1991	1992	1993	1994 e/	1995 e/
Bentonite		5,070	2,816	2,161	2,200	3,000
Cement		239,300	277,400	255,000 r/	308,800 r/ 4	350,000
Gold, mine output, Au content	kilograms	1,154	1,322	1,240	1,073 4/	1,600
Gypsum and anhydrite, crude		16,200	9,115	11,078	11,000	12,500
Lime		2,120	2,003	3,630	3,500	3,600
Petroleum refinery products	thousand 42-gallon barrels	4,543	4,810	4,630	4,700	4,800
Salt, marine e/		15,000	15,000	15,000	15,000	15,000
Sand and gravel	thousand tons	1,170	1,288	1,100	1,200	1,300
Silver, mine output, Ag content	kilograms	1,014	2,240	2,237	2,235 r/ 4	2,400

e/ Estimated. r/ Revised.

1/ Estimated data are rounded to three significant digits.

2/ Includes data available through May 1, 1996.

3/ In addition to the commodities listed, Nicaragua produced a variety of industrial minerals to meet domestic needs. Output of these materials was not repo was insufficient information for projecting estimates.

4/ Reported figure.

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TABLE 2
NICARAGUA: STRUCTURE OF THE INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Bentonite		Empresa Rotowa S.A. (Corporación Nicaragüense de Minas (INMINE), (Government, 100%)	South of Sébaco, Matagalpa Department	4
Cement		Compañía Nacional Productora de Cemento (Government, 100%)	San Rafael del Sur, Managua Department	700
Gold	kilograms	INMINE, 100%	El Limón Mine, León Department; Bonanz mining complex, Zelaya Department; Si mining complex, 1/ Zelaya Department	12,000
Do.		Mining of Nicaragua S.A. (Greenstone Resources Ltd., 75%; Inversiones Mineras S.A., - Grupo IMISA, 25%)	La Libertad Mine, Chontales Department	350
Gypsum		Yesera Centroamericana S.A. (INMINE, 100%)	Santa Rosa del Peñón, León Department	17
Petroleum products	housand 42-gallon barrels	Esso Standard Oil S.A. Ltd. (100%)	Managua, Managua Department	5,400
Silver	kilograms	INMINE, 100%	Bonanza and Siuna 1/ mining complexes, Zelaya Department; El Limón Mine, León Department	3,000

1/ The Siuna Mine is inactive.

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OTHER ISLANDS OF THE CARIBBEAN

By Ivette E. Torres

The Islands of the Caribbean were modest producers of minerals in 1995. In many cases, production was limited to industrial minerals for internal consumption. Several islands produced cement. The economies of other islands, however, relied heavily on exports of mineral commodities, and a few islands were among the top producers of one or two mineral commodities. Bauxite and alumina, cement, chromite, cobalt, crude petroleum, gold, iron and steel, natural gas, nickel, petroleum refinery products, phosphate rock, and salt were among the mineral commodities produced in the Caribbean Islands. The islands reviewed within this chapter were among the modest producers of mineral commodities in the area.

Antigua and Barbuda

The volcanic Islands of Antigua and Barbuda are east of Puerto Rico. Sand, gravel, and crushed stone industries supported the local construction industry. On Antiqua Island, limestone crops out along the north and east coasts and was quarried for the construction industry. Barbuda produced a small amount of salt. Antigua and Barbuda's main trading partners were the Organization of Eastern Caribbean States and the United States.

Aruba

Aruba, of volcanic origin, is northwest of Venezuela. Aruba has few natural resources; thus, mining contributes little to the economy of the island. Coastal Aruba Refining Co. N.V., a subsidiary of Coastal Corp. of Houston, Texas, produced asphalt, diesel fuel, feedstock for Coastal's other refineries, kerosene, and residual fuel oil at the Lago refinery. Petroleum and other mineral products were shipped from the Ports of Oranjestad and Sint Nicolaas.

The Bahamas

The Bahama Islands, on the northern edge of the Caribbean Basin, comprised 20 major islands and thousands of small islands. The islands' coral base rests on the volcanic foundation, but most of the exposed rock is oolitic limestone.

Mineral production on The Bahama Islands was limited to aragonite, cement, petroleum products, salt, sand and gravel, and stone. Aragonite sand was dredged off the Great Bahamas Bank, south of the Biminis. Limestone and sand were produced by Freeport Aggregate Ltd., in Freeport, for the domestic construction industry. Marine salt was produced in evaporation pans on Great Inagua Island, the southernmost island in The Bahamas archipelago. The Bahamas imported all of its oil for the domestic processing of petroleum products. The Bahamas' mineral exports included aragonite blocks, petroleum products, and salt. The United States was The Bahamas' most significant trading partner.

Barbados

Barbados is a relatively small island of the Lesser Antilles about 160 kilometers (km) east of St. Vincent. The mineral sector contribution to the economy was minor. The principal mineral commodities produced in Barbados were crude petroleum and natural gas. Industrial mineral production included cement, clays, limestone, and sand and gravel. The Arawak Cement Co., operated by Trinidad Cement Ltd., produced cement from imported clinker and was the sole producer of cement on the island, exporting to regional markets. The Barbados National Oil Co. Ltd. was the only operating crude oil company on the island. The company also produced natural gas and liquid petroleum gas. The Mobil Oil Barbados Ltd. petroleum refinery is on the southwestern coast. Trinidad and Tobago, the United Kingdom, and the United States were Barbados main trading partners.

Bermuda

Bermuda is a small archipelago of 7 main islands and about 150 other islands and islets resting on volcanic formations. The islands had an insignificant mineral industry in 1995. All mineral commodity requirements were imported, except for some local stone production, primarily coralline limestone. Quarries are privately owned, with low employment requirements. Lacking rivers and streams, Bermuda collects its fresh water from rainwater and seawater desalinization plants. Petroleum was imported. Mineral exports consist almost entirely of the reexport of fuel oil. The United States continued to be one of Bermuda's most important trading partners. Other significant partners included Canada, Italy, and the United Kingdom.

Dominica

The volcanic Island of Dominica is 550 km southeast of Puerto Rico, between Guadeloupe and Martinique Islands, in

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the Lesser Antilles. In 1995, Dominica produced clay, limestone, pumice, volcanic ash, sand and gravel, and volcanic ash primarily for the construction industry. Dominica was the leading producer of fresh water, exporting it to the other Caribbean islands. The Government supported the use of geothermal energy and drilled a number of test wells. Dominica was dependent on imports for oil and raw and semimanufactured materials. Dominica exported small quantities of sand and gravel and crushed stone mostly to Guadeloupe and the Virgin Islands. In 1993, Dominica became a contracting party to the General Agreement on Tariffs and Trade.

Grenada

The most southern of the Windward Island chain, or Lesser Antilles, Grenada consists of Grenada and several islands near the southern Grenadines, near the south end of the Lesser Antilles off the northeast coast of Venezuela. There are no reported mineral industries in Grenada, although limestone, and sand and gravel are produced for the local construction industry.

Guadeloupe and Martinique

Guadeloupe and Martinique are both Overseas Departments of France. Included are the islands of Basse-Terre, Grande-Terre, Iles des Saintes, La Desirade, Marie-Galante, St. Barthelemy, and the French side of Sint Maarten (Saint Martin). Guadeloupe and Martinique are 500 km and 625 km southeast of Puerto Rico, respectively; both are near the northern end of the Lesser Antilles. The Basse-Terre portion of Guadeloupe is volcanic in origin, and the Grand-Terre area is composed of limestone. Martinique is a dormant volcano.

Industrial minerals, such as cement, clays, lime, pumice, salt, sand and gravel, and stone, were mineral commodities produced in Martinique. All mineral products, except for some cement and sand and gravel, were used domestically. Petroleum products were refined on Martinique from imported crude oil.

Haiti

Haiti is part of the western area of the Island of Hispaniola, which it shares with the Dominican Republic. Economic activity remained depressed in 1995. The small mineral industry in Haiti was involved in the production of cement, the mining of clays and limestone for cement production, the quarrying of a small quantity of marble, the production of marine salt, and thedredging for sand and gravel and other minerals used in the construction industry. In northern Haiti, there are small undeveloped deposits of chromite, copper, gold, iron ore, lead, manganese, silver, sulfur, tin, and zinc. Refined petroleum products were all imported. Exxon, Royal Dutch Shell, and Texaco oil companies operate gasoline stations in Haiti.

Montserrat

Montserrat, a dormant volcanic island, is just south of Antigua and Barbuda in the Lesser Antilles. Small quantities of sand and gravel and other quarry products constituted its mineral industry. The island's mineral requirements were imported through the Port of Plymouth.

Netherlands Antilles

The two major islands of the Netherlands Antilles, Bonaire and Curaçao, are northwest of the coastline of Venezuela. The rest of the country, the Saba Islands, Sint Eustatius, and the Dutch side of Sint Maarten, are east of Puerto Rico, 800 km to the north. All of the islands are of volcanic origin. In 1995, mining and mineral production contribute little to the economy of the Netherlands Antilles, which did, however, produce limestone, phosphate rock, refined petroleum products, and solar salt in Curaçao. Salt was exported to other Caribbean islands, New Zealand, and the United States from the Port of Willemstad in Curaçao. Refined petroleum products also were exported to the Netherlands and other countries. Refinería Isla S.A. in Curaçao, a Petróleos de Venezuela S.A. (PDVSA) subsidiary, leased the 113-million-barrel-per-year oil refinery at Willemstad from the Government of the Netherlands Antilles. PDVSA also recovered about 40,000 metric tons of sulfur at its refinery. The ocean terminal and facilities on Bonaire, owned by PDVSA, were used for storage and transshipment. AKZO Salt Antilles N.V. operated a 2,226-hectare, 360,000-metric-ton-per-year solar salt facility on the southern end of Bonaire.

A stone-crushing plant was operating on the Saba Island. Aggregate was quarried on Sint Maarten by Bouwwbedrifj Bowne Winden N.V., a subsidiary of Devcon International Corp. of Deerfield Beach, Florida. Production was consumed primarily by the local construction industry. A petroleum transshipment terminal operated on Sint Eustatius.

Saint Kitts and Nevis

Saint Kitts and Nevis are volcanic islands southeast of Puerto Rico. The Federation of Saint Kitts and Nevis consist of Saint Christopher and Nevis islands. Mining contributed little to their economies. Although Saint Kitts and Nevis' mineral industry produced some construction materials and salt, most basic mineral requirements were imported in 1995. Beach sand mining was proscribed under the 1987 National Conservation and Environmental Protection Act.

Saint Lucia

The volcanic island of Saint Lucia is 150 km north of Grenada in the Lesser Antilles. Gravel and sand pits and pumice quarries supplied the island's construction sector, which is tied to hotel expansion. Hess Oil St. Lucia Ltd. maintained a petroleum storage and transshipment terminal near Castries, the island's capital. Geothermal energy studies

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were conducted at the boiling volcanic sulfur springs near Soufriere on the southwest coast. In 1993, Saint Lucia became a contracting party to the General Agreement on Tariffs and Trade.

Saint Vincent and The Grenadines

The small volcanic islands of Saint Vincent and the Grenadines are between the islands of Saint Lucia in the north and Grenada in the south. A small industrial mineral production supplied sand and gravel and road material needed by the construction industry. Small quantities of salt were privately produced.

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[1]Prepared by George Rabchevsky in 1995 and updated by Ivette E. Torres in 1996.

Major Sources of Information

Antigua

Ministry of Economic Development and Energy
Queen Elizabeth Highway
Saint John's, Antigua

Aruba

Central Voor de Statistiek
Windstraat 21
Oranjestad, Aruba

The Bahamas

Minstry of Agriculture, Trade and Industry
Nassau, The Bahamas

Barbados

Ministry of Trade, Industry, and Commerce
Bridgetown, Barbados, West Indies

Grenada

Ministry of Communications
Saint George's, Grenada

Guadeloupe and Martinique

Bureau de Recherches Geologiques et Minière
Abymes, Guadeloupe, French West Indies

Bureau de Recherches Geologiques et Minière
Fort-de-France, Martinique, French West Indies

Service des Mines et de L'Industries
Poin-a-Pitre, Guadeloupe, French West Indies

Service des Mines et de L' Industries
Fort-de-France, Martinique, French West Indies

Haiti

Bureau des Mines et de Resources Energetiques
Port-au-Prince, Haiti

Saint Lucia

Ministry of Trade, Industry, and Agriculture
Castries, Saint Lucia

Saint Vincent ans the Grenadines

Ministry of Trade, Industry, and Agriculture
Kingstown, Saint Vincent

TABLE 1
ARUBA, NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS:
PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
Aruba:						
Petroleum refinery products	thousand 42-gallon barrels	26,977 r/	35,569 r/	45,199 r/	50,670 r/	52,070 3/
Sulfur, byproduct of petroleum		1,650 r/	9,340 r/	34,300 r/	34,000 r/	31,700 3/
Netherlands Antilles:						
Petroleum refinery products	thousand 42-gallon barrels	78,913	75,323	75,592	72,416	73,657 3/
Phosphate rock e/		15,000	15,000	10,000	15,000	--
Salt e/		350,000	350,000	300,000	420,240 r/ 3/	421,000
Sulfur, byproduct of petroleum		42,500	31,900	31,900	42,500	42,500 3/
Saint Kitts and Nevis, salt e/		5000	5000	5000	5000	5000

e/ Estimated. r/ Revised.
1/ Table includes data available through Apr. 16, 1996.
2/ In addition to commodities listed, crude construction materials (lime, sand, stone, etc.) may also be produced. But data on such production are not available, and information is inadequate to make reliable estimates of output levels.
3/ Reported figure.

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TABLE 2
THE BAHAMAS: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons)

Commodity 2/	1991	1992	1993 e/	1994 e/	1995 e/
Salt	1,100	809	850	900	900
Stone, aragonite	1,210	871	1,100	1,200	1,200

e/ Estimated.
1/ Table includes data available through Apr. 16, 1996.
2/ In addition to commodities listed, crude construction materials (sand and gravel, etc.) may also be produced. But data on such production are not available, and information is inadequate to make reliable estimates of output levels.

TABLE 3
BARBADOS: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1991	1992	1993	1994	1995
Cement, hydraulic	thousand metric tons	200	175	62 r/ 3/	78 r/ 3/	80
Gas, liquefied petroleum	42-gallon barrels	18,900 3/	18,900 3/	18,000	20,000	20,000
Gas, natural:						
Gross	million cubic meters	35	33	33	35	35
Marketed	do.	17	15	15	15	15
Petroleum:						
Crude	thousand 42-gallon barrels	455 r/ 3/	479 r/ 3/	462 r/ 3/	474 r/ 3/	475 3/
Refinery products	do.	2,200	2,120	2,200	2,250	2,250

r/ Revised.
1/ Table includes data available through Apr. 16, 1996.
2/ In addition to commodities listed, crude construction materials (clays, sand and gravel, stone, etc.) were also produced. But data on such production are not available, and information is inadequate to make reliable estimates of output levels.
3/ Reported figure.

TABLE 4
GUADELOUPE AND MARTINIQUE: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Guadeloupe:						
Abrasives, natural:, pumice		230	220	210	210	210
Cement		240	235	230	230	230
Martinique:						
Cement, hydraulic		245	240	220	220	220
Lime	metric tons	5,000	5,000	5,000	5,000	5,000
Petroleum refinery products	thousand 42-gallon barrels	4,800	4,800	4,800	4,800	4,800
Pumice		150	140	130	130	130
Salt		200	200	200	200	200

1/ Table includes data available through Apr. 16, 1996.
2/ In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) may also be produced. But information is inadequate to make estimates of output levels.

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TABLE 5
HAITI: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995
Cement, hydraulic		250,000	200,000	100,000	75,000	50,000
Clays, for cement		40,000	30,000	10,000	10,000	7,000
Sand and gravel:						
Gravel	cubic meters	3,900,000	3,000,000	1,000,000	750,000	750,000
Sand	do.	2,200,000	2,000,000	500,000	250,000	250,000
Stone:						
Limestone, for cement		250,000	220,000	100,000	75,000	50,000
Marble	cubic meters	600	500	200	100	100

1/ Table includes data available through Apr. 16, 1996.
2/ In addition to commodities listed, asphalt, lime, and salt may also be produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.

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PANAMA

By David B. Doan

Mining accounted for less than 0.5% of Panama's gross domestic product (GDP). The Panama Canal dominated the economy, generating about 30% of its GDP. Panama mined gold and silver, and produced industrial minerals, such as cement, clays, limestone, salt, and sand and gravel for domestic use. *(See table 1.)*

Panama's mining law, updated in 1988 to modernize the code and stimulate investment, provided the following: (1) foreign companies were allowed a 4-year concession to work deposits they discovered, with a 2-year extension; (2) extraction concessions were granted for specific mineral classes for a period of 20 to 25 years, and were extendable; (3) extraction concessions were certain if exploration were successful; (4) mine tax rates were reduced to 2% of gross production for base metals and 4% for placer precious-metals; (5) import duties on capital equipment were waived; and (6) minerals produced could be exported freely, exempt from duties. No restrictions were placed on foreign ownership or repatriation of capital, other than a 10% tax on dividends or interest payable to foreign shareholders.

Private companies operated most of the mineral industries in Panama, although the Government held 40% of Petroterminal de Panama, S.A., the crude oil transshipment and pipeline activity associated with the canal. (*See table 2.*)

The United States was Panama's largest trading partner, and Panama was the third largest site of U.S. investment in Latin America, after Mexico and Brazil. Mineral-related exports consisted primarily of scrap metal and petroleum products.

Three large copper deposits in the Cerro Colorado, Botija, and Petaquilla Districts attracted increasing attention. Petaquilla, among the world's five largest undeveloped copper-gold porphyry deposits, with the nearby Botija deposit, had reserves estimated at 495 million tons (Mt) grading 0.53% copper and 0.124 grams per metric ton (g/t) gold, at a 0.19% copper-equivalent cutoff. Owned 52% by Adrian Resources Ltd., and 48% by Inmet Mining Corporation (both of Canada), Petaquilla and Botija, combined with eight other prospects in the concession, were projected by Adrian to include 3,840 Mt containing 31.8 billion pounds of copper, 9.8 million ounces [304,819 kilograms (kg)] of gold, and 962 million pounds of molybdenite.[2]

Greenstone Resources Ltd. (Canada) brought its Santa Rosa gold concession, 1 kilometer south of Canazas, Veraguas Province, into full operation with the likelihood of producing 1,000 kg in 1995.

Manganese deposits were known in several areas in Panama. Caribbean Mining Company Inc. (U.S.) had a 25-year mining concession to reopen the Cerro Viejo Mine, northeast of Colon, containing an estimated 600,000 t of reserves.

Panama produced cement, clays, lime, limestone, marine salt, and sand and gravel in small operations. Cement was produced by Empresa Estatal de Cemento "Bayano" at Calzada Larga and by Cemento Panama, S.A. at Quebrancha. In 1994, the Government sold its 95% share in the Cemento "Bayano" to Mexico's Cementos Mexicanos S.A. A 5% share was sold to employees as part of the country's new pension plan.[3]

In Panama, all crude oil for its refineries was imported from Ecuador, Mexico, Saudi Arabia, and Venezuela. Electrical capacity was rated at 848 megawatts (MW) nationally, 65% of which was hydroelectric. Private companies supplied about 265 MW to the country's grid. A geothermal energy region in southwestern Panama had an estimated potential of 400 MW.

Investment in mining was expected to offer the strongest opportunities for expansion of capital in Panama

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[1]Company announcement. Adrian Resources Ltd. as of Dec. 1995.
[2]Journal of Commerce (New York): Aug. 26, 1994, p. 2A.

Major Sources of Information

Direccion General de Recurssos Minerales
Ministerio de Comercio e Industrias
P.O. Box 8515, Panama 5, Panama
Telephone: (507) 36-1823; Fax: (507) 36-3173
Refineria Panama S.A.
Calle 39 y Avenida Balboa
P.O. Box 5270, Panama 5, Panama
Telephone: (507) 27-1433; Fax: (507) 27-0190

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TABLE 1
PANAMA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993 e/	1994 e/	1995 e/
Cement e/		300,000	250,000	571,300 r/ 3/	615,000 r/ 3/	350,000
Clays:						
For cement		368,582	415,058	420,000	400,000	420,000
For products		75,343	72,849	72,900	72,500	74,000
Gold	kilograms	194	250	255	245 r/	1,100
Lime e/		1,320	1,500	1,500	1,750	2,000
Petroleum refinery products e/	thousand 42-gallon barrels	8,000	9,000	9,500	10,000	10,000
Salt, marine e/		18,000	20,000	20,000	20,000 3/	22,000
Silver	kilograms	91	162	165	175	175
Stone, sand and gravel:						
Limestone:						
For cement		289,855	665,720	670,000	700,000	700,000
For other uses		47,968	50,000 e/	55,000	57,000	62,000
Sand and gravel	thousand tons	1,941	2,448	2,500	2,700	3,000
Sand and silica		17,613	22,600	22,500	22,500	23,000

e/ Estimated. r/ Revised.
1/ Estimated data are rounded to three significant digits.
2/ Includes data available through May 1, 1996.
3/ Reported figure.

TABLE 2
PANAMA: STRUCTURE OF THE INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Cementos Mexicanos S.A. (95%) (employees 5%)	Calzada Larga, Panamá Province	300
Do.		Cemento Panamá, S.A. (private, 100%)	Quebrancha, Panamá Province	310
Gold	kilograms	Minas Santa Rosa, S.A. (Greenstone Resources Ltd. Canada, 100%)	Santa Rosa Mine, Veraguas Province	1,800
Do.	do.	Transworld Exploration, S.A. and Minera Remance (Peru) (100%)	Remance Mine, Veraguas Province	293
Do.	do.	Sociedad de Inversiones DXTAPA, S.A. (private, 100%)	Espíritu Santo de Cana Mine, Darién Province	NA
Petroleum products	million 42-gallon barrels	Refinería Panamá, S.A. [Texaco Panama Inc. (U.S.), 100%]	Las Minas, Colón Province	14
Silver	kilograms	Transworld Exploration, S.A. and Minera Remance (Peru) (100%)	Remance Mine, Veraguas Province	200

NA Not available.

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THE MINERAL INDUSTRY OF

PARAGUAY

By Pablo Velasco

Paraguay's economy remained predominantly agricultural and dedicated mainly to livestok with a small minerals industry that accounted for less than 1% of gross domestic product (GDP). In 1995, the Paraguayan GDP grew by 4.4% to an estimated $7.4 billion,[1] compared with 3.5% in 1994. Export revenues were $646 million for the first 9 months of 1995, representing a 20.7% decrease from $804 million for the same period of 1994. Paraguay had $1.1 billion in international reserves and a public external debt of about $1.3 billion, equivalent to 17.5% of its GDP. The inflation fell in 1995 to 10.35% and the fiscal surplus was $141 million.

The strategic geographic location of Paraguay in the Southern Cone Common Market (MERCOSUR), in which the other participants are Argentina, Brazil, and Uruguay, and the abundant hydroelectric power available, made the country attractive for certain metallurgical industries. Paraguay continued to offer attractive trade policies and business opportunities in terms of its solvency, freemarket economy with equal guarantees, and liquidity to attract foreign investors to explore for hydrocarbons, particularly in the Chaco Region, where a local drilling company claimed to have discovered natural gas.

Mineral production in Paraguay was made up solely of industrial minerals including clays, glass sand, gypsum, kaolin, limestone, pigments, small amounts of iron oxide pigments, stone, and talc. Mineral-related activities included manufacture of cement and lime, production of pig iron and steel, and petroleum refining from imported raw materials. *(See table 1.)*

Known mineral deposits included high-grade limestone deposits along the Paraguay River which provided high-grade raw materials for the cement industry, calcium carbide manufacture, precipitated calcium carbonate, lime, and other mineral-related products. A wide variety of marbles, granites, and volcanic rock were produced, and sandstone was extracted for the manufacture of glass.

Geophysical surveys have identified oil and natural gas potential in the El Palmar Largo and Gran Boquerón Chaco Regions. Paraguay received relatively little attention from the mining community during the past years, however, in 1995 Yamana Resources from Canada was seeking ratification for a 150,000-hectares concession to explore for mineral resources and Taiwan China Steel Co. announced the commitment to establish a ferroalloy plant in Paraguay.

Cement was produced by Industria Nacional del Cemento (INC), a Government-owned company, which operated two plants: the Puerto Vallemí cement plant in Concepción Department with a 400,000-tons per year (t/yr) capacity, and the Itapucumi clinker plant in Villeta Department with a 600,000-t/yr capacity. The Government was selling a 20-year concession for the INC's plant at Vallemi, 450 kilometers up the river from Asunción. The new owner had to invest about $50 million in two new furnaces and a clinker mill. Argentine, Brazilian, French, and New Zealand firms bid for the cenent company, INC. The bids were scheduled to opened in October 1995. Once the bids had been checked, and the bidders' financial viability assessed, the auction would go forward to a second round.

Aceros del Paraguay S.A. (ACEPAR), operated a steel plant at Villa Hayes, 20 km north of Asunción, as a joint Paraguayan-Brazilian venture estimated to have cost $290 million, based on iron ore and coal imported from Brazil. The Government-owned company, Petróleos Paraguayos S.A. (PETROPAR), produced refined petroleum products for domestic consumption at its Santa Elisa refinery in Asunción.

Paraguay's oil needs continued to be met by imports from Algeria and Argentina, although dependency was reduced somewhat by the increased use of the country's large hydroelectric potential estimated at 56,000 megawatts, and the development of an alcohol fuel industry. In 1995, electricity was supplied mainly from the hydroelectric plants at the Itaipú Dam complex, a joint Brazilian-Paraguayan hydroelectric powerplant on the Paraná River; and the Yacyretá-Apipé Dam, a joint Argentinean-Paraguayan hydroelectric project 320 km downstream from Itaipú.

The transportation system in Paraguay comprised 28,300 km of highways, 970 km of railroads, and 3,100 km of inland waterways. Argentina, Bolivia, Brazil, Paraguay, and Uruguay moved closer to the integration of river transportation with the inauguration of two locks in the Tiete River in Brazil. After completion of this waterway, the cost per ton of transportation of Paraguayan minerals and goods reportedly will decrease from the current $29 to about $10.

[1]Where necessary, values were converted from Paraguayan guaraníes

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(G) to U.S. dollars at the average market rate of G1,972.0=US$1.00.

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TABLE 1
PARAGUAY: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
Cement, hydraulic e/	thousand tons	326	326	490 3/	570 3/	600
Clays: e/						
Kaolin		74,000	74,000	74,000	74,000	74,000
Other	thousand tons	1,900	1,900	1,900	1,900	1,900
Gypsum e/		4,500	4,500	4,500	4,500	4,500
Iron and steel:						
Pig iron		67,642 r/	92,136 r/	81,233 r/	90,000 r/	103,000 3/
Steel, crude		61,000	86,000	86,000	85,000 r/	96,000 3/
Lime e/		100,000	100,000	100,000	100,000	100,000
Petroleum, refinery products: e/						
Liquefied petroleum gas	thousand 42-gallon barrels	100	100	100	100	100
Gasoline	do.	560	560	560	600	600
Jet fuel	do.	160	160	160	200	200
Kerosene	do.	40	40	40	50	50
Distillate fuel oil	do.	740	740	740	800	800
Lubricants:						
Oil	do.	20	20	20	20	20
Grease	do.	5	5	5	5	5
Residual fuel oil	do.	350	350	350	350	350
Refinery fuel and losses	do.	25	25	25	25	25
Total	do.	2,000	2,000	2,000	2,150	2,150
Pigments, mineral,natural, ocher e/		330	330	330	330	300
Sand, including glass sand e/	thousand tons	2,000	2,000	2,000	2,000	2,000
Stone: e/						
Dimension	do.	70	70	70	70	70
Crushed and broken:						
Limestone (cement and lime)	do.	600	600	600	600	600
Other	do.	2,000	2,000	2,000	2,000	2,000
Marble		750	750	750	750	750
Talc, soapstone, pyrophyllite e/		200	200	200	200	200

e/ Estimated. r/ Revised.
1/ Includes data available through June 1996.
2/ In addition to commodities listed, construction materials (clays, gravel, miscellaneous rock, sand, and weathered tuffs) were presumably produced. Available information is inadequate to make reliable estimates of output levels of these commodities.
3/ Reported figure.

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THE MINERAL INDUSTRY OF

PERU

By Alfredo C. Gurmendi

In 1995, Peru, with a population of almost 24 million, had a gross domestic product (GDP) of about $55 billion.[1] Minerals and related industries were 11% of Peru's 1995 GDP. Mining export revenues, including petroleum, represented about 52% of Peru's total export earnings.

The Peruvian GDP experienced a 12.7% growth during 1994 and a 6.9% growth in 1995. The inflation rate was reduced from about 15.4% in 1994 to 10.3% in 1995. The country's total foreign debt amounted to about $27.5 billion, and its reported net international reserves were about $6.6 billion by yearend 1995.

After the Peruvian Government succeeded in controlling the terrorist group called shining path (sendero luminoso) and stabilizing the country's economy, foreign investors viewed such efforts as a distinct sign of the real changes that took place in Peru, making it an attractive open-market economy in Latin America. The country slashed subsidies and tariffs, freed foreign exchange and interest rates, liberalized international investment rules, and embarked on a sweeping privatization process. At the end of 1995, the National Commission for Foreign Investment and Technology reported a total of $5.3 billion of new investments, of which mining received 63%, petroleum 17%, and the other sectors of the economy 20%.

According to the Carta Minera & Panorama Petrolero (CMPP) of the Andean Air Mail & Peruvian Times, Lima, the Sociedad Nacional de Minería y Petróleo (SNMP), and the Private Investment Promotion Committee, the Peruvian privatization program began on July 19, 1991, privatizing about 200 state-owned corporations and netting more than $3.6 billion, with committed new investments of about $4 billion. In 1995 alone, the Government privatized 30 firms collecting $2.6 billion; investment commitments to modernize and expand operations were $2 billion.

The dramatic changes in Government policies and the rebounding of Peru's economy resulted in a boom in foreign investment, attracting international corporations that were looking for business opportunities.

The privatization process continued to be managed by COPRI, and responsibility for specific privatization was vested in special committees, Comités de Privatización, whose members were selected from the ranks of leading professionals and officials, mainly from the private sector.

Legal procedures to obtain mining rights were made easier by the enactment of complementary legislation, Supreme Decree No. 018 of July 9, 1992. The Government no longer had exclusive control over exploration, mining, smelting, and refining of metals and fuel minerals. Individuals and private companies were allowed to hold mining permits in Peru.

The state-owned Petróleos del Perú S.A. (PERUPETRO) managed energy-related activities for the Government. All mineral resources, including geothermal resources, belonged to the Government of Peru. The Government granted concessions for use by the State, private companies, and individuals. The administration and management of all mining activities rested in the executive branch. Since 1992, the Central Bank had the legal authority to buy gold.

The General Directorate of Environmental Affairs (DGAA) of the Ministry of Energy and Mines has the responsibility to address environmental problems resulting from energy and mining activities and is mandated to implement the current environmental code and regulations. During 1995, the National Council for Environment (Consejo Nacional del Ambiente) made progress in data base information gathering, which was reported by energy and mining firms under the Preliminary Environmental Assessment, the Environmental Impact Assessment, and the Environmental Adjustment and Management Program. However, concrete followup activities would still need to be undertaken to ensure the DGAA's strengthening and restructuring in a manner that would enhance its efficiency in carrying out environmental planning, intersectoral coordination, and environmental management.

In 1995, according to the statistics reported by CMPP, SNMP, and the Anuario de la Minería del Perú, published by the Ministry of Energy and Mines, the Peruvian metals and minerals production increased substantially compared with that of the previous year *(See table 1.)*

While the Latin American region was experiencing a dramatic economic upsurge as it neared the turn of the century, Peru, as a member of the Andean Common Market (ANCOM, comprising Bolivia, Colombia, Ecuador, Peru, and Venezuela), sold about 8% of its exports to the other ANCOM members and about 5% to the other countries in Latin America. In 1995, in an attempt to increase interregional trade, ANCOM met in Trujillo, Peru, and sought to unify external tariffs.

During 1995, the country's mining production, valued at $2.8 billion, increased by about 2.6% compared to that of 1994, of which an estimated $2.6 billion was exported.

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Peru's export earnings, including petroleum, amounted to $2.9 billion, or 52% of its total exports of $5.5 billion. Imports increased by 38% to $7.7 billion, creating a deficit of $2.2 billion. Peru imported crude oil valued at $590 million, which created a trade deficit of $323 million for the energy sector.

The largest state-owned mining company is Empresa Minera del Centro del Perú S.A. (CENTROMIN). Southern Peru Copper Corp. (SPCC), also a large mining company, is privately owned. Private firms, mostly controlled by local interests, dominated the medium and small mining operations.

The new hydrocarbon law eliminated PERUPETRO's exclusive rights in the industry, such as control over secondary recovery of crude oil, refining, and imports and subsequent resale of petroleum and byproducts. The law created more favorable oil and gas exploration and production contract terms for investors, which resulted in an increased number of domestic and foreign companies expressing interest in participating in exploration contracts with PERUPETRO (*See table 2.*)

In 1995, Peru's copper output increased to 404,900 metric tons (t) of copper from its mine operations, or about 11% compared with the previous year, with a value of $1.2 billion.

SPCC remained the largest copper producer in the country with an output of 248,038 t of copper from its mine operations at the Toquepala and Quajone open pits; the output was 2% higher than that of 1994 (242,976 t). Magma Copper Co., Peru's second largest copper producer, privatized in 1994, completed its first year operating the Tintaya Mine and produced 66,683 t of copper, achieving a 42% increase with respect to its 1994 output.

CENTROMIN reported a total production of 35,313 t of copper from its seven base metal mines; while its La Oroya complex produced 65,957 t of refined copper, or 7% more than that achieved in 1994. Cyprus-Amax Minerals Co. reported a production of 28,560 t of copper, which was 50% more than that of 1994. Other copper producers were Cía Minera Pativilca (6,684 t) and Cía Minera Condestable S.A. (5,582 t). An additional 14,431 t came from medium- and small-sized mines in the country.

In 1995, Peru's gold production increased by 23% from the previous year, amounting to 56.5 t; the country exported 41.8 t of gold valued at $463 million. Newmont's Yanacocha Mine remained the largest gold producer in the country, having produced 17.4 t of gold.

Gold recovered as a byproduct from the concentrates of the nation's polymetallic mines amounted to 4 t. Other private gold producers in 1995 were Minera Auríffera Retamas, 3.3 t; Cía. Minera Poderosa, 2.2 t; and Consorcio Minero Horizonte, 2.1 t. Cía. de Minas Orcopampa S.A., Buenaventura's subsidiary, produced 1.9 t of gold as a byproduct of its base metal concentrates. Magma produced 1.2 t of byproduct gold from its Tintaya copper mine. Small mines reported 2.6 t, and an unknown number of "garimperos" (informal individual miners) accounted for almost half, or 25.8 t, of gold produced in the country.

The southeastern Andes have well-known gold placers on the Inambari River and its tributaries. Placer gold production was concentrated in the Inca and Mariategui Regions, although gold was recovered from placers in rivers and streams throughout the jungle.

In 1995, Shougang Hierro Peru, subsidiary of China's Shougang Corp., produced 3.8 million metric tons (Mt) of iron ore, 17% less than the previous year's output. The Marcona Mine produced all types of iron for export such as pelletized fines, blast furnace pellets, and sinter feed. In 1995, the firm exported 6.5 Mt of iron ore, valued at $100 million, to Argentina, China, Japan, the Republic of Korea, and the United States. Local sales were made to Empresa Siderúrgica del Perú.

In 1995, Peru produced 232,540 t of lead and 506,000 t of zinc. Lead production increased by 2.7% and zinc decreased by 25.8% compared with 1994 outputs.

CENTROMIN reported a production of 89,695 t of refined lead and 68,374 t of zinc metal and continued as the leading lead-zinc producer in the country.

In 1995, Cía Minera San Ignacio de Morococha S.A., remained Peru's largest private zinc producer with 67,283 t. Cía Minera Santa Luisa, a subsidiary of Mitsui Mining Co. of Japan, produced about 37,557 t of zinc and 17,886 t of lead from its Huanzalá Mine. Cía. Minera Milpo S.A., the largest private lead producer in Peru, reported 25,552 t of lead and 41,767 t of zinc outputs. Milpo was 73.8% owned by local shareholders and 26.2% by foreign investors. Cía. Minera Atacocha S.A. produced about 27,674 t of zinc and 15,110 t of lead.

In 1995, Asarco Corp. transferred its subsidiary, Corporación Minera Nor Perú, to Panamerican Silver of Canada. The company reported a production of 17,799 t of zinc, 5,776 t of lead, and 86 t of silver from its Quiruvilca Mine in northern Peru.

Silver production increased about 9.5% to 1,908 t in 1995, making Peru the world's third largest producer after Mexico and the United States. The medium-sized companies accounted for 63% of total output; large mining companies contributed 33%; and small companies, the remaining 11%.

In 1995, CENTROMIN led silver producers in the nation's total output, with 613 t. Buenaventura and its subsidiary, Orcopampa, dominated the medium-sized silver-mining sector with 202 t.

Minsur S.A., continued being Peru's only tin producer in 1995. Production from its San Rafael Mine in Mariátegui Region was 22,231 t of tin, a 10% increase from that of 1994. Thus, Peru was the second largest tin producer in Latin America after Brazil. Tin concentrates

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were exported to Brazil and Thailand.

Two private companies in Peru were mining tungsten at the Pasto Bueno Mine in Ancash and at Regina in Puno Region. The Palca XI Mine in Puno, operated by Sociedad Minera Regina, was the main producer. In 1995, production increased to 728 t, or about 184% of that of 1994.

In 1995, five cement companies operated in Peru and Cementos Lima S.A., reported a production of about 860,000 t of cement, or about 40% of Peru's total cement output. The Atocongo has a design capacity of 1 million metric tons per year (Mt/yr), with limestone quarries nearby. Most of the cement was exported primarily to Chile.

Cementos Norte Pacasmayo S.A., was the second largest cement company in Peru, accounting for 21% of total production. It has an installed capacity of 1 Mt/yr, with a plant utilization of 50%. The plant is 670 kilometers (km) north of the Panamerican Highway in Pacasmayo, La Libertad Region.

The phosphate deposits of Bayóvar in northern Peru, scheduled for privatization in mid-1996, had proven reserves of 570 Mt. In 1995, only 37,500 t of phosphate was produced. The 90,000-metric-ton-per-year (t/yr) phosphate plant was operated by Empresa Minera Regional Grau Bayóvar, S.A. Phosphate shipments continued to New Zealand under a 100,000-t contract signed with Norphos International Ltd. of Auckland. Other shipments went to Chile and Costa Rica through the Port of Paita.

Liquid fuels provided more than 60% of Peru's total energy requirements. Petroleum accounted for 23% of energy consumption, and electricity met 10% of energy demand. Natural gas supplied 7% of the country's energy mix.

Peru's largest coal deposits are at Alto Chicama, 140 km north of Trujillo in La Libertad Region. Other coal deposits occur in the Cuenca del Santa in the Marañón Region and coal basins of Goyllarisquizga and Hatun Huasi in the Cáceres Region of central Peru.

Natural gas was primarily piped from the Talara Basin in the Grau Region to the Talara refinery on the coast. Two gasfields in the Ucayali Basin were candidates for development. Peru's proven natural gas reserves at the end of 1995 were estimated at 196 billion cubic meters (m^3). The Aguaytia gasfield, approximately 41 km west-northwest of Pucallpa, had proven reserves of 12.5 billion m^3 of gas and 13.2 million barrels (Mbbl) of condensate. The country's largest potential gasfield is Camisea in Cuzco. The San Martín and the Cachiriari prospects at Camisea had estimated potential reserves of about 305.8 billion m^3 of gas and 725 Mbbl of condensate (natural gas liquids). The fields are distant from potentially accessible markets; the Ministry of Energy and Mines, however, indicated that new infrastructure was needed and must be developed. It was reported that the Government was planning to sign an agreement in mid-1996 with the Mobil-Shell consortium to develop Camisea.

In 1995, petroleum production in Peru averaged 121,762 barrels per day (bbl/d) compared with 1994's output of 127,300 bbl/d. For the eighth consecutive year, Peru imported crude oil and petroleum products to satisfy its internal demand.

Peru's total crude oil production of 44 Mbbl in 1995 came from PERUPETRO, 33%; Occidental Petroleum Corp. of the United States, 43%; and other producers, 20%. About 65% of the country's crude oil production came from the jungle blocks in the Ucayali Region; the remaining was produced at the coastal and offshore fields in the north of Peru. The country's declining petroleum reserves were estimated at about 400 Mbbl in 1995, compared with the 1981 peak of 835 Mbbl. The largest oil refinery in Peru, Lima, is La Pampilla, with a capacity of about 102,000 bbl/d. The second largest oil refinery in Peru, Talara, has a capacity of about 60,000 bbl/d.

Peru has 1,801 km of railroads and 69,942 km of roads, of which 7,459 km were paved and 13,538 km were unpaved. There were 8,600 km of navigable waterways and tributaries to the Amazon River system and 208 km of waterways into Lake Titicaca. Peru has an installed electrical generating capacity of 5,042 megawatts, 60% of which came from hydroelectric plants.

Important mineral industry ports included Callao, Ilo, Matarani, Paita, San Nicolás, and Talara on the Pacific Ocean and Iquitos on the Amazon River. Also, a petroleum depot at Bayóvar serviced the 800-km North Peru crude oil pipeline. Natural gas and liquid gas were transported through a 64-km pipeline.

Peru's rebounding economy, with strong capital flow from domestic and foreign investors, was expected to bring long-term benefits to the energy, mining, and related mineral industries, which remained the most promising prospects for the Peruvian economy.

The privatization of CENTROMIN and PERUPETRO, scheduled for 1996-97, was expected to continue improving prospects for the mining and oil and gas industries. However, the Government continues facing difficulties with the opposing political parties and labor unions.

Representatives of every sector of the Peruvian economy were optimistic about the future of the country. Current investments are modernizing Peru's industrial infrastructure. Furthermore, future investments in the minerals sector were projected to be about $8 billion during the next 5 years, of which $1.8 billion would be dedicated to mineral exploration, $2 billion for the expansion of current mine operations, and $4.2 billion for the development of new mines.

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[1]Where necessary, values have been converted from Peruvian nuevos soles (S/.) to U.S. dollars using the average exchange rate

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for 1995 of S/.2.285 = US$1.00.

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Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.
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U.S. Embassy, Lima, U.S. Department of State: Industrial Outlook Report on Minerals, annual.

TABLE 1
PERU: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
METALS						
Antimony:						
Mine output, Sb content		278	339	240	460	460
Metal		227	311	195	379 2/	380
Arsenic, white 3/		661	644	391	286 2/	285
Bismuth:						
Mine output, Bi content e/		610	550	1,000	1,000	1,000
Metal		377	419	937	871 2/	870
Cadmium:						
Mine output, Cd content e/		526 2/	500	500	600	600
Metal		138	399	472	507 2/	510
Chromium, mine output, Cr content e/		410	400	400	400	400
Copper:						
Mine output, Cu content		382,277 r/	379,128 r/	381,250 r/	365,513 2/	404,990 2/
Sulfate, Cu content		4,700	3,300	3,400	3,500	3,500
Metal:						
Smelter:		269,000	254,000	254,000	244,000 2/	244,000
Refined		228,000	232,000	241,000	243,000 2/	243,000
Electrowon		17,900	19,000	18,200	44,000 2/	44,000
Total refined		245,900	251,000	259,200	287,000 2/	287,000
Gold:						
Mine output, Au content 4/	kilograms	9,934	16,000	23,650 r/	42,702 r/	52,500 2/
Metal	do.	5,749 r/	4,183 r/	5,148 r/	3,611 2/	4,000 2/
Indium	do.	3,140	3,050	3,190	4,000 2/	4,000
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	3,590	2,850	4,930	7,430 2/	7,500
Fe content	do.	2,331	1,845	3,400	4,830 2/	4,900

See footnotes at end of table.

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TABLE 1--Continued
PERU: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
METALS--Continued						
Metal:						
Pig iron	thousand tons	207	147	147 e/	150	150
Sponge iron e/		24,100 2/	20,000	20,000	20,000	20,000
Ferroalloys e/		390	360	360	360	360
Steel ingots and castings	thousand tons	404	343	417	506	515
Semimanufactures		251	242	242 e/	250	250
Lead:						
Mine output, Pb content		217,864 r/	214,007 r/	224,695 r/	233,510 r/	232,530 2/
Metal		74,511	83,951	87,117	88,071	89,577 2/
Manganese, mine output, Mn content e/		160	160	160	200	200
Molybdenum, mine output, Mo content		3,094 r/	5,629 r/	4,777 r/	4,631 r/	4,600 2/
Selenium, metal, refined	kilograms	12,400	14,400	17,100	21,000 2/	21,000
Silver:						
Mine output, Ag content		1,927 r/	1,614 r/	1,631 r/	1,742 r/	1,908 2/
Metal, refined		631	691	589	710 2/	710
Tellurium, metal	kilograms	13,400	18,600	17,400	28,000 2/	28,000
Tin, mine ouptut, Sn content		6,568 r/	10,044 r/	14,310 r/	20,275 r/	22,331 2/
Tungsten, mine output, W content		1,230	802	398	256 2/	256
Zinc:						
Mine output, Zn content		628,000	603,000	665,000	682,000 2/	682,000
Metal		154,000	124,000	157,000	182,000 2/	182,000
INDUSTRIAL MINERALS						
Barite		9,250 r/	16,579	23,988	53,074 r/	37,420 2/
Boron materials, crude (borates)		26,400	26,600	36,500	30,000	30,000
Cement, hydraulic e/	thousand tons	2,200	2,090 2/	2,090	2,100	2,100
Chalk e/		91,500	100,000	101,200	101,200	101,200
Clays:						
Bentonite		14,611 r/	14,210 r/	10,250 r/	27,682 r/	26,372 2/
Fire clay		7,320	9,500	9,500 e/	9,500	9,500
Kaolin		7,100	5,500 e/	5,100	5,100	5,100
Common clay		396,000	67,900	138,000 e/	138,000	138,000
Diatomite e/		25,500 2/	25,000	35,100	35,100	35,100
Feldspar		3,000 e/	10,000	11,400	11,400	11,400
Gypsum, crude		160,000 r/	35,300	35,300 r/	35,000	35,000
Lime e/	thousand tons	14,000	14,000	14,000	14,000	14,000
Mica e/		100	100	100	100	100
Nitrogen, N content of ammonia e/		95,000	90,000	90,000	90,000	90,000
Phosphate, crude		18,200	37,300	37,400	37,400	37,400
Salt, all types e/		200,000	238,000 2/	238,000	238,000	238,000
Stone, sand and gravel:						
Stone:						
Dolomite e/		43,800 2/	40,000	40,000	50,000	50,000
Flagstone e/		300,000	300,000	300,000	300,000	300,000
Granite e/		2,000	2,000	2,000	2,000	2,000
Limestone	thousand tons	3,200	1,480	1,610	1,600	1,600
Marble e/		30,000	10,300 2/	13,300	12,000	12,000
Onyx e/		500	204 2/	150	150	150
Quartz and quartzite (crushed) e/		40,500 2/	40,000	40,000	40,000	40,000
Shell, marl e/		4,000	4,000	4,000	4,000	4,000
Slate e/		18,000	18,000	18,000	18,000	18,000
Travertine e/		5,000	3,990 2/	3,990 2/	5,000	5,000
Sand and gravel:						
Construction	thousand tons	3,100	960	871	900	900
Silica sand	do.	150	152	115	100	100
Sulfur, elemental:						
Native e/		100	100	100	100	100
Byproduct of metallurgy e/		66,000	60,000 r/	60,000 r/	60,000 r/	60,000

See footnotes at end of table.

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TABLE 1--Continued
PERU: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994 e/	1995 e/
INDUSTRIAL MINERALS--Continued:						
Sulfur, elemental--Continued:						
Sulfuric acid, gross weight		207,000	242,000 r/	227,000	220,000	220,000
Talc and related materials: e/						
Talc		2,100 2/	2,000	1,200	1,200	1,200
Pyrophyllite		8,000	8,000	8,000	8,000	8,000
Total		10,100	10,000	9,200	9,200	9,200
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite run-of-mine		125,000	79,800	31,100	35,000	35,000
Bituminous, run-of-mine		25,500	14,500	41,000	45,000	45,000
Total		150,500	94,300	72,100	80,000	80,000
Coke, all types e/		10,000	10,000	10,000	10,000	10,000
Gas natural: e/						
Gross	million cubic meters	1,010	1,200	1,200	1,200	1,200
Marketed	do.	566	570	570	600	600
Natural gas liquids: e/						
Natural gasoline and others 5/	thousand 42-gallon barrels	299 2/	295	295	295	295
Butane	do.	4 2/	4	4	4	4
Total	do.	303 2/	299	299	299	299
Petroleum:						
Crude	do.	41,900	42,300	46,000	46,500 2/	46,500
Refinery products:						
Liquefied petroleum gas	do.	1,480	1,540	1,540 e/	1,540	1,540
Gasoline motor	do.	9,120	9,090	9,090 e/	9,090	9,090
Jet fuel	do.	2,530	2,170	2,170 e/	2,170	2,170
Kerosene	do.	5,470	5,530	5,530 e/	5,530	5,530
Distillate fuel oil	do.	9,590	11,600	11,600 e/	11,600	11,600
Lubricants	do.	54	38	38 e/	38	38
Residual fuel oil	do.	10,400	24,400	24,400 e/	24,400	24,400
Asphalt	do.	264	270	270 e/	270	270
Other e/ 6/	do.	16,700 2/	848	848 e/	848	848
Total		55,608	55,486	55,486 e/	55,486	55,486

e/ Estimated. r/ Revised.
1/ Table includes data available through Apr. 1996.
2/ Reported figure.
3/ Output reported by Empresa Minera del Centro del Peru, S.A.
4/ Much of Peru's placer gold production was not reported.
5/ Includes hexane.
6/ Includes refinery fuel and losses.

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TABLE 2
PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Antimony	Empresa Minera del Centro del Peru (CENTROMIN) (Government, 100%)	Smelter at La Oroya, Junin Department	700 1/
Barite	Barmine S.A., (private, 100%)	Santa Cruz de Cocachacra, Huarochiri Department	NA
Bentonite	Minerales Andinos S.A., (NL Industries, 90%)	Vichayal Mine, Piura Department.	9
Bismuth	CENTROMIN	Refinery at La Oroya	1,000 1/
Copper	Southern Peru Copper Corp. (SPCC) (Asarco Corp., 63.0%; Phelps Dodge Overseas Capital Corp., 16.3%; The Marmon Group Inc., 20.7%)	Cuajone, Moquegua Department, and Toquepala, Tacna Department	300
		Smelter at Ilo, Moquegua Department	250
		Refinery at Illlo, Moquegua Department	175
Do.	CENTROMIN	Cobriza, Huancavelica Department; Casapalca and Yauricocha, Lima Department; Morococha and San Cristobal, Junin Department	60
		Smelter at at La Oroya	65
		Refinery at La Oroya	60
Do.	Magma Copper Corp. (private, 100%)	Tintaya Mine, Cuzco Department	50
Do.	Cyprus-Amax Minerals Co. (private, 100%)	Cerro Verde, Arequipa Department	30
		Electrowon at Cerro Verde	20
Dolomite	Minera Baribent S.A., (private, 100%)	Esperanza, Ancash Department	25
Gold	Minera Yanacocha S.A., (Newmont Mining Corp., 38%; Cia. de Minas Buenaventura, 32%; Cedimin S.A., 25%; World Bank's IFC, 5%)	Yanacocha and Magui-Magui mines Cajamarca Department	16,000 2/
Do.	Cia. Minera Ponderosa S.A., (private, 100%)	Ponderosa, La Libertad Department	1,300 2/
Do.	Cia. de Minas Orcopampa S.A., (Buenaventura, 100%)	Orcopampa, Arequipa Department	1,050 2/
Do.	Asesoria Contable Minera S.A., (private, 100%)	Ocona, Santa Clarita, Explatoro, and Molino de Oro, Arequipa Department	1,000 2/
Do.	Cia. Aurifera Rio Inambari S.A., (Cia. Minera del Sur S.A., 84%, Aurifera Claudia, 16%)	Rio Caichive, Madre de Dios Department	200 2/
Iron ore	Shougang Hierro Peru S.A., (private, 100%)	Marcona, Ica Department.	13,000
Lead	CENTROMIN	Cerro de Pasco, Casapalca, San Cristobal, Morococha, and Yauricocha Minas	85
		Smelter at La Oroya	93
		Refinery at La Oroya	95
Do.	Cia. Minera Milpo S.A., (private, 100%)	El Porvenir Mine, Pasco Department	20
Do.	Cia. Minera Santa Luisa S. A., (private, 100%)	Huanzala Mine, Junin Department	40
Molybdenum	SPCC	Cuajone, Moquegua Department and Toquepala, Tacna Department	NA
Petroleum, crude	Petroleos del Peru S. A., (PERUPETRO) (Government, 100%)	Onshore Piura Department; northeast and central jungle areas, Loreto Department	68,000 3/
Do.	Petroleos del Mar S.A., (PERUPETRO, 100%)	Pacific coast, offshore Piura Department	28,000 3/
Do.	Occidental Petroleum Corp. del Peru (private, 100%)	Northeastern jungle, Loreto Department	90,000 3/
Petroleum products	PERUPETRO	Refineries at Talara, Lima, Iquitos, Marsella, and Pucallpa	185,500 3/
Silica sand	Minera Baribent S.A., (private, 100%).	Maria G. and Martin I., Junin Department	27
Silver	CENTROMIN	Cerro de Pasco, Cobriza, Monterrosas, Morococha, San Cristobal, and Yauricocha Mines	466,000 2/
		Refinery at La Oroya	809,000 2/
Do.	Cia. de Minas Buenaventura S.A., (Buenaventura) (private, 83%; CENTROMIN 17%)	Julcani and Huachocolpa Mines Huancavelica Department, Uchucchacua Mine, Lima Department	187,000 2/
Do.	Cia. de Minas Orcopampa S.A., (Buenaventura, 100%)	Orcopampa Mine, Arequipa Department	161,000 2/
Steel	Empresa Siderúgica del Peru (Government, 100%)	Chimbonte, Ancash Department	550
Do.	Empresa Laminadora del Pacifico S.A., (private, 100%)	Pisco, Ica Department	180
Tellurium	CENTROMIN	Refinery at La Oroya	12 1/
Tin	Minsur S.A., (private 100%)	San Rafael Mine, Puno Department	2,500 1/
Tungsten	Minera Regina S.A., (private, 100%)	Palca XI, Puno Department	1,400 1/
Do.	Fermin Malaga Santolalla S. A., (private, 100%)	Pasto Bueno, Ancash Department	1,000 1/

See footnotes at and of table.

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TABLE 2--Continued
PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc	CENTROMIN	Casapalca, Cerro de Pasco Morococha, San Cristobal, and Yauricocha mine units	235
		Refinery at La Oroya	70
Do.	Refineria Cajamarquilla S.A., (Cominco Ltd. of Canada, 87%; Marubeni Corp. of Japan, 13%), Minero Peru	Refinery at Cajamarquilla	102
Do.	San Ignacio de Morococha S.A., (private, 100%)	San Vicente Mine, Junin Department	70
Do.	Cia. Minera Santa Luisa S. A., (private, 100%)	Huanzala Mine, Junin Department	20

NA Not available
1/ Metric tons per year.
2/ Kilograms per year.
3/ 42-gallon barrels per day.

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THE MINERAL INDUSTRY OF

SURINAME

By Alfredo Gurmendi

The Surinamese economy is supported by the bauxite and alumina industries, which accounted for about 80% of the country's export revenues or $300 million. Suriname's gross domestic product (GDP) was $1.2 billion[1] in 1994, the last year for which data were available. Mining in general accounted for about 4% of GDP. During the period 1991-94, Suriname accounted for 6% of U.S. alumina imports and ranked third behind Australia, 73% and Jamaica, 10%.

In the mineral sector, Suriname was interested in attracting foreign investment via joint ventures, particularly in the diamond, gold, kaolin, sand, and stone industries; the Nation sought to obtain environmentally sound modern mining technology and to establish a very competitive mineral industry. A lack of financing hindered exports, and the absence of environmental measures increased deforestation in the vicinity of bauxite mining areas and gold placer operations. Bauxite and alumina continued to dominate the industry's annual output. Gold, petroleum, and sand production were expected to increase in the near term. *(See table 1.)*

Suriname's privately owned multinational companies mined bauxite and processed alumina and aluminum. In 1995, Suriname's output of some 3.3 million metric tons (Mt) of bauxite made it the sixth largest producer worldwide. The Paranam plant controlled by Suriname Aluminum Co. (SURALCO, 55%) a subsidiary of Alcoa Inc. (ALCOA) of the United States and NV Billiton Maatschappij (Billiton, 45%), a medium-sized bauxite refinery and aluminum smelter 25 km south of Paramaribo, produced 1.6 Mt of alumina and 32,000 t of aluminum. By the end of 1995, Billiton and ALCOA were conducting additional drilling for the second stage of a bankable feasibility study on the Bakkuis bauxite project. The project is a joint venture between Billiton Maatschappij Suriname, owned by Billiton-Gencor Group, and SURALCO. Suriname's bauxite reserves were estimated by SURALCO at 575 Mt.

Gold concessions were negotiated with N.V. Grassalco, the state-owned company. Gold was produced by numerous small placer operators and sold to the Government. Golden Star Resources Ltd. of Canada (GSR), continued gold exploration during the year. The Guiana Shield, according to recent reports, is an area of intense exploration for gold in northern South America. Gold mineralization similar to that in neighboring French Guiana occurs in the Precambrian Paramaka formation of Suriname, and gold placers are worked by garimpeiros (small-scale independent miners) south and east of the South Benzdorp Area; their estimated gold production could amount to 30 kilograms per year. Reportedly, Canarc Resource of Canada (CANARC) acquired an 80% interest in the Sara Creek concession covering 22,500 hectares (ha) in east-central Suriname about 150 km north of Paramaribo. CANARC was conducting feasibility studies for a large surface gold-mining operation at Sara Kreek. GSR and Cambior Inc. (Cambior) announced mine reserves of 24 Mt grading 1.4 g/t of gold on the Gross Rosebel property. Gold Vessel Resources (GVR), a subsidiary of Saint Genevieve Resources of Canada, signed an agreement with Surinamese interests to participate in three gold properties. Two of them comprised 20,000 ha in the Sipalvini District, where small-scale gold mining was being conducted. Also, GVR and partner Margo Mining Co. applied for permits to explore 65,000 ha on properties held by GSR near Gross Rosebel. GVR applied for five permits to explore a 259-square-kilometer area near the western border with Guyana.

The state-owned oil company, Staatsolie Maatschappij NV (STAATSOLIE), reported that about 5,000 barrels per day (bbl/d) of heavy, sweet crude oil were produced from the Tambaredjo and Borneo fields east of Paramaribo. The company is expected to increase output at Tambaredjo to 6,500 bbl/d by late 1996. STAATSOLIE continued with the construction of a 55-km pipeline from the Catharina Sophia Field at Tambaredjo to the Suriname River export terminal at Tout Lui Faut, 5 km south of Paramaribo. The Tout Lui Faut canal was proposed as the site of the STAATSOLIE refinery. STAATSOLIE reported that Tambaredjo and Borneo fields have proven reserves of 25 million barrels (Mbbl), with an additional 40 Mbbl as probable reserves.

SURALCO and Billiton will control the bauxite mining operations, with GSR, Cambior, KWG Resources, and CANARC involved in gold exploration. STAATSOLIE will continue to be involved in the development and production of petroleum. *(See table 2.)*

Because mineral rights continued to be vested in the State, exploration rights are granted by the Government. The primary mineral produced was bauxite, although gold, nickel, platinum, and tin deposits also occurred. The

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bauxite-alumina-aluminum industry will probably continue to be the single most important sector in the Surinamese economy. However, the Government continues to be interested in the development of nontraditional exports to increase foreign currency earnings. Also, located on the eastern portion of the Guyana Shield greenstone belt, Suriname apparently was ready to receive the spillover from the recent gold activity in Brazil, Guyana, and Venezuela. Thus, foreign investors will pay closer attention to the gold deposits in the Suriname's extension of the Guyana Shield.

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[1]Where necessary, values have been converted from Surinamese guilders or florins (Sf) to U.S. dollars at the rate of Sf1.785 = US$1.00 (Jan. 1995).

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Geologisch Mijnbouwkundige Dienst
Kleine Waterstraat 2-6
Paramaribo, Suriname
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Industrieterrein 21, Flora
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Paramaribo, Suriname

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U.S. News and World Report: New World of Nations, annual.

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TABLE 1
SURINAME: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Thousand metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
Aluminum:						
Bauxite, gross weight		3,200	3,250 2/	3,300	3,300	3,300
Alumina		1,510	1,600	1,600	1,600	1,600
Metal, primary		29	32	30	32	32
Cement, hydraulic		50	50	50	50	50
Clays: Common		16	16	20	20	20
Gold, mine output, Au content	kilograms	30	300	300	300	300
Petroleum, crude	thousand 42-gallon barrels	1,500	1,500	1,500	1,500	1,500
Sand and gravel:						
Gravel		35	35	35	35	35
Sand, common		160	160	160	160	160
Stone, crushed and broken		50	50	50	50	50

e/ Estimated.
1/ Includes data available through Apr. 1996.
2/ Reported figure.

TABLE 2
SURINAME: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Suriname Aluminum Co. (SURALCO) [ALCOA, USA, 55%; and NV Billiton Maatschappij (Billiton), 45%]	Refinery at Paranam, District of Para	2,000
Aluminum	SURALCO, (100%)	Smelter at Paranam, District of Para	50
Bauxite	do.	Mines at Coermotibo and Accaribo, District of Marowijne	2,000 1,500
	Billiton 76%; SURALCO, 24%	Accaribo Mine, District of Para	1,000
Cement	Vensur N.V. (private, 100%).	Paramaribo, District of Para	60
Gold	No major operating companies	South and east Suriname	NA
Petroleum	Staatsolie Maatschappij Suriname NV (Government, 100%)	Tambaredjo, District of Saramacca	1,825

NA Not available.

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THE MINERAL INDUSTRY OF

TRINDAD AND TOBAGO

By Ivette E. Torres

Trinidad and Tobago's gross domestic product (GDP) grew by 2.7 % in 1995.[1] Its economy continued to depend heavily on oil and natural gas, but the growth in GDP was attributed partly to increases in the manufacturing and construction sectors. Twenty eight percent of Trinidad and Tobago's GDP, 22% of Government revenue, and 68% of earnings from foreign exchange in 1995 originated from the energy sector. This represents a decreasing trend in energy's importance to the economy in part because of decreasing production levels of crude petroleum and Trinidad and Tobago's efforts to develop its natural gas downstream industries.

In addition to oil and natural gas, Trinidad and Tobago is a significant producer and a major exporter of ammonia. The country also produces byproduct sulfur, cement, iron and steel, limestone, and petroleum refinery products. The country's mineral industry is characterized by mixed private and Government ownership, with efforts to privatize that began in the early 1990's and continued in 1995. In November, a new Government was elected. The new Government planned to focus on reforming the tax system as a measure to encourage private investment. It also planned to decrease its ownership and direct participation in mineral production and oil exploration and production.

The United States is Trinidad and Tobago's main trading partner, accounting for about 50% of the country's total trade. Trinidad and Tobago's second leading trading area is Latin America and the Caribbean. A member of Caribbean Community and Common Market, Trinidad and Tobago has expressed interest in becoming a member of the North America Free Trade Agreement.

While oil production and refining have been significant sources of foreign exchange earnings, natural gas has become an extremely important factor in the domestic economy. As an inexpensive and abundant energy source, it is the basis of Trinidad and Tobago's industrial development. In June 1995, the proven gas reserves were 10.09 trillion cubic feet (285.72 billion cubic meters), probable reserves were 6.0 trillion cubic feet (169.9 billion cubic meters) and possible reserves were 2.68 trillion cubic feet (75.9 billion cubic meters).[2]

Trinidad and Tobago's petrochemical industry is the largest consumer of natural gas. Demand for this sector is expected to increase to 59% of the total by yearend 1996. The country continues to expand its natural gas based industries.

In 1995, plans for a new liquefied natural gas (LNG) plant were proceeding smoothly with the establishment of Atlantic Liquefied Natural Gas. The $1 billion project, expected to be completed by 1999, will expand Trinidad and Tobago's natural gas into the export market. Atlantic Liquefied Natural Gas is owned by AMOCO Trinidad (34%), British Gas (26%), Repsol International (20%), Cabot LNG (10%), and Trinidad and Tobago's National Gas Company (10%).[3] Planned production capacity is 425 million cubic feet per day (12.03 million cubic meters per day), almost 70% of the country's total production in 1995. Cabot has agreed to purchase 60% of the plant's output. Enaga, a subsidiary of Spain's Gas Natural S.A., agreed to purchase the remainder.

In 1995, Trinidad and Tobago exported about 80% of the 1.7 million tons of ammonia (nitrogen content) produced during the year. Its high level of exports was exceeded only by Russia, the world's leading exporter of ammonia.

Arcadian Corp. (Arcadian), a major producer of ammonia in Trinidad and Tobago, continued to expand its production capacity in 1995. In December, the U.S. company announced plans to construct a new 650,000-ton-per-year ammonia plant in the Point Lisas industrial sector in Caroni County, Trinidad. Construction of the plant was scheduled to begin in February 1996. This was in addition to a 680-ton-per-day (about 250,000-ton-per-year) plant that was being relocated to Trinidad by Arcadian in 1995 and that was scheduled to be completed in February 1996. Most of Arcadian's ammonia sales (93%) from its Trinidad plants goes to the United States.

Production of crude petroleum decreased slightly from that of 1994 to 47.8 million barrels. With the exception of the increase of about 3% achieved in 1994, production of crude petroleum has been decreasing steadily and significantly since 1978 when it reached almost 84 million barrels. In 1995, output of petroleum refinery products increased slightly. While Trinidad and Tobago's industry has benefited tremendously from the shift to natural gas, the country recently has developed a new petroleum exploration program, mainly through production sharing contracts.[4] As part of this program, two new offshore blocks were awarded in late 1995 to Enron and BHP Petroleum/Elf Aquitaine, with eight more blocks to be bid

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for at the beginning of 1996.

[1]Inter-American Development Bank Annual Report 1995, p. 105.
[2]Petroleum Economist. Trinidad and Tobago. A Petroleum Economist Special Report. V. 62, No. 6, June 1995, pp. 121-134.
[3]James, C. J. Com. Commodities /Chemicals. Amoco, Cabot LNG Join in $1 Billion Trinidad Venture. Jan. 10, 1996, p. 20.
[4]Petroleum Economist. Trinidad and Tobago. Exploration to Restore Production. V. 62. No. 10, Oct. 1995, p. 50.

Major Sources of Information

Ministry of Energy
Port-of-Spain, Trinidad, W.I.
Telephone: (809) 623-6708

TABLE 1
TRINIDAD AND TOBAGO: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995 e/
Asphalt, natural		20,000 e/	24,565	24,600	16,700	17,000
Cement, hydraulic		485,396	482,000	527,000	583,000	600,000
Gas, natural						
Gross	million cubic meters	8,730	7,000	8,200	7,700	7,500
Marketed	do.	5,700 r/	5,500 r/	6,200 r/	6,240 e/	6,119
Iron and steel:						
Iron, sponge		683,000 r/	675,000 r/	830,006 r/	911,800	1,077,000
Steel, crude		440,000 r/	553,000	519,000 r/	631,000	738,000
Semimanufactures (rolled) e/		290,000	450,000 2/	446,000	525,000	550,000
Lead, refined (secondary) e/		1,800	1,800	1,700	1,600	1,600
Natural gas liquids	thousand 42-gallon barrels	120	280	320	384	380
Nitrogen, N content of ammonia	thousand tons	1,530	1,570	1,462	1,649 r/	1,696
Petroleum :						
Crude	thousand 42-gallon barrels	53,085 r/	49,934 r/	46,680 r/	48,009 r/	47,811
Refinery products	do.	39,546 r/	39,834 r/	38,561 r/	36,299 r/	36,973
Stone, limestone	thousand tons	1,030	1,420	1,580	1,600 e/	1,600
Sulfur, byproduct of petroleum e/ 3/		5,000	5,000	5,000	4,500	4,500

e/ Estimated. r/ Revised.
1/ Table includes data available through Oct. 1996.
2/ Reported figure.
3/ Sulfur as a byproduct of natural gas may be produced, but information is inadequate for reliable output estimates.

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TABLE 2
TRINIDAD AND TOBAGO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity holders	Location of main facilities	Annual capacity
Anhydrous ammonia	Trinidad Nitrogen Co. Ltd. (Norsk Hydro AS, 49%; Government, 51%)		
	Tringen I	Point Lisas, Caroni Co.	370. 1/
	Tringen II	do.	450. 1/
Do.	Arcadian Trinidad Ltd., (Arcadian Corp., U.S., 100%)	do.	710. 1/
Do.	Federation Chemicals (Norsk Hydro AS, 100%)	do.	230. 1/
Asphalt	Lake Asphalt of Trinidad and Tobago (1978) Ltd. (Government, 100%)	Brighton, St. Patrick Co.	60.
Cement	Trinidad Cement Ltd. (Cemex of Mexico, 20%; Government, 80%)	Claxton Bay, Caroni Co.	540 cement. 600 clinker.
Iron and Steel	Iron and Steel Co. of Trinidad and Tobago (Caribbean Ispat Ltd.)	Point Lisas, Caroni Co.	900 sponge iron. 700 steel. 600 wire rod.
Do.	Nucor Iron Carbide Inc. (Nucor, USA, 80%; Samitri, Brazil, 20%)	do.	320 iron carbide.
Petroleum:			
Crude	Amoco Trinidad Oil Co. Ltd. (Amoco International Oil Co. Ltd., 100%)	Poui, Samaan, Teak, and Cassia fields, offshore\ east of Guayaguayare	95,000. 2/
Do.	Petroleum Company of Trinidad and Tobago Ltd. (Petrotrin) (Government, 100%)	Point Fortin, Ortoire, Penal Forest fields, offshore, east of Guayaguayare	20,000. 2/
Do.	Trinmar Ltd. (Texaco Trinidad Inc., 33 1/3%; Petrotrin, 66 2/3 %)	Soldado fields, offshore in Gulf of Paria	40,000. 2/
Do.	Petrotrin (Government, 100%)	Soldado field, onshore; Galeota field, offshore (exported)	24,000. 2/
Products	do.	Point Fortin, St. Patrick Co.	80,000. 2/
Do.	do.	Point-a-Pierre, Victoria Co.	220,000. 2/

1/ Based on 340-day operating year.
2/ Barrels per day

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THE MINERAL INDUSTRY OF

URUGUAY

By Pablo Velasco

Uruguay's economy remained predominantly agrarian, with 90% of utilized land being devoted to stockraising. The mining industry of Uruguay evolved from small-scale to more capital-intensive mining operations. Mineral exploitation was currently limited to the extraction of a small number of industrial minerals including clay, granite, gravel and limestone, with minor production of semiprecious stones and agates. However, in recent years some significant base metals had been discovered, and commercial gold production was expected to commence by mid-1997 from American Resources Corp.'s San Gregorio gold project. The gross domestic product (GDP) for 1995, which did not change from 1994, was $13.8 billion,[2] while the rate of inflation was 35.4% by yearend, representing a decrease from that of 1994, when it was 44.1%. Mining accounts for 0.5% of GDP. Foreign debt increased by 4% to $2.25 billion to the end of October 1995, according to the Central Bank. The gross debt increased to $4.8 billion, unemployment reached 10.7% in 1995 compared with 1994, and the country's international reserves reached $1.01 billion compared with that of 1994. For the first 10 months of 1995, Uruguay's total exports and imports were $1.7 billion and $2.3 billion, respectively.

In 1995, the Government sought to increase exports by relaxing regulations on participation of foreign investors in the mineral industry and by requiring no tariffs for imports of equipment, machinery, tools, and accessories used in prospecting, exploring, mining, and processing of mineral commodities.

On May 17, the Uruguayan Chamber of Deputies ratified the Ouro Preto Protocol, which regulates the institutional aspects of the Southern Cone Common Market, (MERCOSUR). The approval took place three and a half months after the Senate had ratified the aforementioned treaty, which will now be submitted to the executive branch for its promulgation.

The Finance Minister underlined "the importance of the MERCOSUR for the future of the Uruguayan economy," and announced that Uruguay's trade deficit with MERCOSUR fell by $75 million in the first quarter of 1995, the reduction in the deficit being the result of a 32% increase in exports to Brazil, worth a total of $159 million. This partially offset the deficit with Argentina, which increased by 16% to $63 million.

Provisions in the investment policies of Uruguay did not discriminate against foreign companies. Government policies allowed 100% foreign ownership, and there were no restrictions on the repatriation of capital and profits, on buying or selling foreign currencies, or on employment of either Uruguayans or foreigners. The current Mining Code granted titles that guaranteed investment in mining activities for up to 30 years, with an optional extension of 15 years. Uruguayan mining legislation was based on ownership of all mineral deposits, and grants titles for prospecting, exploration, and exploitation. Under Uruguayan law, an environmental impact study must be carried out before mining could begun. The study was then evaluated by the Ministry of Environment.

Mining in Uruguay was for agate, amethyst, gold and industrial minerals, such as clays, dimension stone, dolomite, feldspar, granite, gypsum, limestone, high-quality marble, pumice, quartz, sand and gravel and talc, barite, bentonite,corundum and pumice, one million ton per year of cement were produced by Administración Nacional de Combustibles, Alcohol y Portland (ANCAP) at its Minas and Paysandú plants and by other companies in Uruguay. Compañía Uruguaya de Cementos Portland decided to build a 1,100 tons per day (t/d) cement plant in Verdun some 200 kilometers (km) north of Montevideo. The Mahoma gold project, 60 km northwest of San José, came on-stream at an initial production of 1.25 t/yr. Expansion plans would double gold production in late 1997. Dolomite was mined for use in the glass and construction industries, for steel, and in refractories. Limestone was produced principally for portland cement production. Various clays were mined for producing brick, pipe, tile, and whiteware. Talc was mined for use in the paper industry and in ceramics, cosmetics, insecticides, and pharmaceutics. Feldspar was mined for the ceramics industries and glass. *(See table 1.)*

The Government allowed duty-free importation of many of the capital goods needed in the mining industry. Investment in prospecting and mining increased as a result of favorable legislation designed to relax regulations of foreign companies in the minerals sector.

Several North American mining companies, including American Resource Corp. (ARC), Gold Standard, and Santa Fe Pacific, were exploring for minerals in Uruguay. San José Mining Co., a subsidiary of Canada's Bond International Gold Ltd. (BIG), and Steel S.A., a subsidiary of Brazil's Mineração e Participacoe, invested $40 million in precious-metal and other metal exploration. Reportedly, ARC of Greenbrae, California, the first foreign company

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to mine gold in Uruguay in modern times, expected to be operating its second Uruguayan gold mine, the San Gregorio mine, in early 1997 at a projected rate of 2.1 t/yr of gold (68,000 ounces of gold per year). San Gregorio had proven and probable reserves of 5.6 million tons of minable ore with about 13.1 tons of gold contained. ARC currently controlled significant land areas in both northern and southern Uruguay, which it had under an extensive exploration program. ARC developed an initial 1.25-t/yr gold mine at Mahoma, 130 kilometer from Montevideo.

During 1995, 80% of Uruguay's fuel energy requirements was refined by ANCAP at its Teja plant in Montevideo.

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[1]Text prepared May 1996.

[2]Where necessary, values have been converted from Uruguayan Pesos ($) to U.S. dollars at the average market rate of $7.2=US$1.00.

Major Sources of Information

Administración Nacional de Combustibles, Alcohol y Portland
Montevideo, Uruguay
Ministerio de Industria y Energía
Montevideo, Uruguay

Major Publications

Banco Central del Uruguay, Montevideo, Uruguay: Boletín Estadístico (annual report).
Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.

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TABLE 1
URUGUAY: PRODUCTION OF MINERAL COMMODITIES e/ 1/

(Metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
Aluminum, secondary		42	42	42	50	45
Barite		15	15	15	15	15
Cement, hydraulic		500,000	500,000	500,000	700,000 r/ 2/	1,000,000 2/
Clays, unspecified		150,000	150,000	150,000	150,000	150,000
Coke, gashouse		8,000	8,000	8,000	8,000	8,000
Corundum		45	45	45	50	45
Feldspar		3,000	3,000	3,000	3,000	3,000
Gemstones, semiprecious:						
Agate		100	100	100	100	100
Amethyst		80	80	80	100	90
Gold	kilograms	–	300	300	300	900
Gypsum		145,000	145,000	145,000	145,000	145,000
Iron and steel:						
Iron ore		5,000	5,000	5,000	5,000	5,000
Metal:						
Ferroalloys, electric-furnace ferrosilicon crust		250	250	250	250	200
Steel, crude		41,245	55,153	35,933 r/	36,000 r/	40,000 2/
Semimanufactures		18,000	46,753 r/	35,953 r/	36,000 r/	37,000 2/
Lime		12,000	12,000	12,000	12,000	12,000
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	700	700	700	700	750
Gasoline	do.	1,850	1,850	1,850	2,000	2,100
Jet fuel	do.	200	200	200	300	300
Kerosene	do.	410	410	410	500	500
Distillate fuel oil	do.	2,970	2,970	2,970	3,500	3,600
Lubricants	do.	60	60	60	100	100
Residual fuel oil	do.	2,580	2,580	2,580	3,000	3,000
Unspecified	do.	500	500	500	500	500
Refinery fuel and losses	do.	30	30	30	50	150
Total	do.	9,300	9,300	9,300	10,650	11,000
Sand and gravel:						
Sand, common	thousand metric tons	1,500	1,500	1,500	1,500	1,500
Gravel	do.	500	500	500	500	500
Stone:						
Dimension		10,000	10,000	10,000	10,000	10,000
Crushed and broken, alum schist		8,000	8,000	8,000	10,000	10,000
Dolomite		19,000	19,000	19,000	20,000	20,000
Limestone		750,000	750,000	750,000	750,000	750,000
Marble		4,000	4,000	4,000	5,000	5,000
Marl		7,000	7,000	7,000	10,000	10,000
Quartz		300	300	300	500	500
Other, including ballast	thousand metric tons	2,000	2,000	2,000	2,000	2,000
Sulfur, elemental, byproduct		2,000	2,000	2,000	2,000	2,000
Talc, soapstone, pyrophyllite		1,500	1,500	1,500	1,500	1,000
Tuff, Tufa		3,500	3,500	3,500	3,500	3,500

e/ Estimated. r/ Revised.
1/ Includes data available through June 7, 1996.
2/ Reported figure.

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THE MINERAL INDUSTRY OF

VENEZUELA

By Ivette E. Torres

The economy of Venezuela improved modestly after 2 years of decreases. The gross domestic product (GDP) increased by 2.2% after decreases of 2.5% and 3.3% in 1993 and 1994, respectively.[1] The increase was due to a strong performance of the oil and manufacturing sectors. However, inflation, as measured by the consumer price index, increased by 57% after a 46% in 1993 and a 71% increase in 1994. At yearend, the Bolívar was devaluated from 170 per U.S. dollar to 290 per U.S. dollar.

Government efforts to privatize public corporations continued to be slow, with only a couple of companies being privatized in 1995. The Government planned to privatize companies in transportation, telecommunications, banking, electric power, mining, cement, and steel. The slow progress in the Government's ability to privatize its industries has been attributed in part to the country's poor economic performance in recent years, high rate of inflation, increasing budget deficit, and price controls established in 1994. However, plans to privatize some units of Corporación Venezolana de Guayana (CVG), the Government's holding company for basic industries, were approved by Congress in 1995.[2] The Government announced that CVG's steel producer C.V.G. Siderúrgica del Orinoco C.A., aluminum smelters Aluminio del Caroní S.A. and Industria Venezolana de Aluminio C.A.(Venalum), bauxite and alumina producer C.V.G. Bauxalum C.A. (Bauxalum), C.V.G. Carbones del Orinoco and C.V.G. Venezolana de Ferrosilicio C.A. would be the first entities to be offered to the private sector. In May 1995, shares of those affiliates were transferred to the Venezuelan Investment Fund, the entity responsible for all privatization efforts in Venezuela. CVG, with almost 60 affiliate companies, was formed in 1960. The Government planned to use the revenue from the sale toward payment of its foreign debt. In 1995, Venezuela's public foreign debt was $26.1 billion. At yearend, even though CVG continued to be on the list of Government entities to be privatized, its priority within the group to be sold was uncertain.

The Government of Venezuela held preliminary talks with the International Monetary Fund (IMF) in 1995, but economic conditions, decreased fiscal reserves, and inflation forced the Government to consider terms that were followed by protests earlier in the decade when IMF loan terms were announced.

Venezuela's mining law dates back to 1945. For several years, the Government has been working on a new mining law that would attract investment for development of the country's mining sector, but the bill has not yet become law. As these efforts began, a number of international companies became interested in participating in Venezuela's exploration and development, particularly in gold. However, interest has been decreasing as tax structures within the new bill were considered uncompetitive.[3] In addition, the bill fails to provide protections for the companies to risk investment in the sector. According to *Mining Journal*, in the Bolívar State in the period of 1 year the number of companies exploring for gold decreased from 70 to 15.

During the year, the Ministry of Energy and Mines announced that it would review all 435 existing gold and diamond concession contracts previously negotiated by CVG after the Procuraduría General de la República (Office of the Attorney General) found them to be illegal. CVG had negotiated the contracts after the Ministry had delegated its authority to the Government company.[4] Reportedly, the Attorney General established that the previous two administrations gave private companies mineral rights over the land instead of concessions. In addition, the agreements failed to specify the level of taxation and other obligations as specified by article 13 of the Mining Law. Concessions offered to individuals were illegal because they were not approved by the Congress. While the Government tried to reassure the companies investing in the country, the absence of a new mining law, and the uncertainties created by possible reversals like the one affecting the concession, are reasons for foreign investors to proceed with great caution.

Venezuela is a significant producer of several mineral commodities. Even though petroleum, natural gas, and petroleum products continued to dominate the country's economy in 1995, and Venezuela's nonfuel mining industry contributed modestly to the country's GDP, Venezuela was an important producer of some nonfuel minerals. It was among the leading five world producers of bauxite and ranked eighth in the production of both alumina and aluminum. Venezuela also produced metal and metal products such as gold, iron ore, direct-reduced iron, steel, and ferroalloys. In the industrial mineral sector, Venezuela produced cement, diamonds, and many other mineral commodities. Venezuela's production of coal, still modest by world standards, was on the increase and the country was planning to expand its production significantly.

Venezuela's total exports were $18.3 billion in 1995, while total imports amounted to about $11.6 billion. Of the total, about 75% was from the oil sector. According to

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Central Bank statistics, nonoil exports totaled $4.5 billion, of which $234 million was from mineral products (1.3% of total exports). Exports of construction materials totaled $111.8 million and exports from the steel sector was $1.7 billion.

Venezuela's aluminum sector was controlled by the Government, with a small percentage of ownership by the private sector. Bauxite and alumina were produced by Bauxalum, a new CVG company that resulted from merging the bauxite producer C.V.G. Bauxita Venezolana C.A. with the alumina producer Interalumina. Venalum, the aluminum smelter would become part of the group as the Government of Venezuela was preparing the sector to be the first of CVG affiliates to be offered to the private sector. It was believed that the Government planned to offer the companies plus the other aluminum smelter, Alcasa, as a block.

In 1995, production of bauxite increased by 17%. Alumina production increased by 26% and aluminum output increased by 8%.

Production of gold decreased by 28% to 7,259 kilograms. The low level of gold being sold to the Central Bank in 1995 is believed to be a direct result of the price controls imposed by the Government in 1994. Although traditionally a portion of the gold production has been sold in the black market, especially by small-scale, illegal miners, the decrease in official production in 1995 probably indicates an increase in sales in the black market. During the year, the Government began efforts to integrate the illegal, small-scale miners into the formal economy. Small-scale miners would be able to operate in designated areas of the country if they formed associations or cooperatives.[5] This action was taken after violent incidents increased in concession areas when illegal miners refused to abandon those areas. In September, CVG awarded gold concessions to six associations formed by small-scale miners in the southeastern part of Bolívar State.[6] According to CVG, 5,000 small-scale miners would benefit from this agreement. The accord would also indirectly benefit 7,000 additional people.

Interest in gold has decreased significantly because of economic, legislative, and administrative conditions that are not attractive to foreign investors, even as Venezuela lifted its monopoly on gold purchases[7] Even though many investors are still in Venezuela, and evaluations of exploration targets continued, some of the projects greatly anticipated by the sector are still on hold.

Las Cristinas, the most anticipated gold project in Venezuela with ore reserves of 233 million tons with 1.21 grams of gold per ton, which was originally scheduled for production in 1995, did not come on-stream during the year. A final decision to proceed with the project was postponed until 1996 by Placer Dome, the company with 70% interest in the project, with production to begin in 1998. One of the problems with Las Cristinas in 1995 was that the Ministry of Energy and Mines did not recognize the validity of the contract between Placer Dome and CVG, claiming jurisdiction over the contract.

Venezuela's largest private producer, Monarch Resources Ltd. (Monarch), produced 48,850 ounces (1,519 kilograms) from La Camorra mine in 1995.[8] Its production at the Revemin mill, 17,695 ounces (550.4 kilograms), decreased significantly from the 1994 level, reportedly due to lack of consistent higher grade feed. The company revised its annual production forecast to 90,000 tons of ore with a gold production of 50,000 ounces (1,555 kilograms). The company revised its reserves in January 1996 to reflect the recalculation of reserves in the upper zones due to the shorter strike length of the B zone, a lower than predicted grade for other upper zones, and lower estimates for the lower level zones. The remaining reserves were 354,000 ounces (11,011 kilograms) measured and indicated gold , 66,000 ounces (2,052 kilograms) of inferred gold, and 20,000 ounces (622 kilograms) of gold in other mineralization.

In November, the Government awarded Monarch a gold export license, the first to be awarded in Venezuela since the Government lifted the Banco Central's monopoly early in the year.

Production of iron ore in Venezuela increased by 6% in 1995. Venezuela was among the top 10 producers of iron ore in the world. Ferrominera del Orinoco C.A. (Ferrominera), a subsidiary of CVG, continued to be the sole producer of iron ore in Venezuela. In 1995, the company announced plans to invest $2.5 billion in 1996-2000.[9] Of the $2.5 billion, $325 million would be invested in the mining sector, $320 million would be invested in pelletization, and $1.85 would be invested in iron reduction technology. Ferrominera's proven reserves were 1.96 billion tons of high grade iron ore in 1991.[10]

Venezuela was the world's leading producer of direct-reduced iron (DRI), and it was the third largest producer of steel in Latin America, after Brazil and Mexico. Recently, Venezuela has developed a different strategy to expand its production capacity and improve its existing facilities in the iron and steel sector through the formation of joint ventures in which the Government will hold a minority interest.[11] In December, the Government of Venezuela approved a $600 million joint-venture project of Ferrominera and the Republic of Korea's Dongkuk Still Mill Co. Ltd., and Japan's Kobe Steel Ltd. to build a steel plant in Venezuela. Construction of the Guayana Steel Mill, with a production capacity of 1 million tons, was scheduled for construction in 1996.[12] That was just one of many joint-venture efforts planned by Ferrominera for the near future. Other efforts include the construction of two pellet plants with a capacity each of 4 million tons per year, and five DRI plants with a total capacity of 7 million tons.

In May, Anglo American Corp. of South America Ltd. (AMSA), a subsidiary of Minorco S.A., completed an 18-month feasibility study of the Loma de Hierro (also known as Loma de Nickel) nickel project in Aragua/Miranda States. The feasibility study defined an ore body with reserves of 40

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million tons grading 1.5% nickel and 18.3% iron.[13] The proposed operation, an open pit mine and a ferronickel plant, would produce about 18,000 tons of nickel in ferronickel for the first 7 years of production, decreasing to about 16,000 tons per year for the remaining 20 years of the mine's life. The Government of Venezuela, through the Ministries of Mines and Energy and Environment, approved the project during the second part of the year. In 1995, the Loma de Hierro project was owned by Jordex Resources of Canada and Corporación Caracas of Venezuela (90%) and by AMSA (10%). In August, Jordex and Corporación de Caracas offered AMSA the opportunity to increased its share of the Loma de Hierro project to 85%. AMSA had 6 months to exercise that option.

Venezuela's cement industry is small by world standards. In Latin America, it ranks fourth after Brazil, Mexico, and Colombia, although output is well below capacity. Production in 1995 was estimated to have increased slightly to 7 million tons. Venezuela's cement industry in recent years has changed dramatically. Ownership of most of its capacity has changed from the domestic private sector to the foreign private sector.[14] Venezuela's largest cement company with a clinker capacity of 5.3 million tons per year, C.A. Cementos de Venezuela is controlled by the Mexican cement company Cementos Mexicanos S.A. Lafarge (France) and Cementfabrik Holderbank AG (Switzerland) hold significant interest in four other companies. Consolidada de Cementos, C.A. (Conceca), with a clinker capacity of almost 1.6 million tons, was acquired by the Holderbank Group in early 1995. At the same time Cementos Caribe, C.A., with a clinker production capacity of about 1.1 million tons, became part of the Conceca concern.

The U.S. company Cargill, Inc. of Minneapolis, Minnesota, entered into a joint venture with Productora de Sal C.A (Produsal), a subsidiary of the Government-owned company Petroquímica de Venezuela S.A. (Pequiven) to produce 800,000 tons of solar salt at los Olivitos, Zulia State.[15] Pequiven had shared ownership of Produsal with Grupo Zuliano in a 40% to 60% joint venture. The company planned to begin commercial production at yearend 1996, achieving a 450,000-ton output level in 1998 for domestic consumption. Plans for production capacity call for exports to other Latin American countries through Pequiven.

Agip Spa, the Italian energy company, sold its 50% share of Carbones de Guasare S.A., which includes the Paso Diablo mine, in the Guasare coal basin in Zulia State to Ruhrkohle AG and Shell Coal International. Carbones de Zulia S.A., a Petróleos de Venezuela S.A. (PDVSA) company retained its 50% of the company. Carbones de Guasare estimates minable open pit reserves at 400 million to 500 million tons and 50 million tons of underground reserves.[16] The new owners continued with plans to increase the company's output to 18 million tons by 2001, including the output from Carbones de Socuy S.A. The plan called for $1 billion investment, which would include the expansion of Paso Diablo's output to 8 million tons per year and the development of the Socuy mine with a similar output level, with new port and railroad systems. Plans called for the Socuy mine to begin production at a smaller scale (1 million to 2 million tons) in 1997.[17]

Venezuela's 1995 official production of crude petroleum was 868 million barrels, close to its Organization of Petroelum Exporting Countries (OPEC) quota of 861 million barrels. However, several analysts have estimated production at anywhere between about 940 million barrels to 1,004 million barrels, about 8% to 16% higher than the OPEC quota and 9% to 17% higher than the official figure.[18] Production in 1994 had been 955 million. Venezuela was the leading supplier of petroleum and refinery products to the United States. It supplied about 19% of the U.S. net imports. U.S. imports of crude from Venezuela increased by about 11% from those of 1994.

Venezuela's oil company, PDVSA, was the third largest refiner in the world with a capacity of 2.4 million barrels per day with refining capacity in the United States, Sweden, Curaçao (leased), and Germany.[19] The company crude oil and natural gas reserves were 64 billion barrels and 140 trillion cubic feet, respectively.

In July, the Congress approved a major step in the opening in the oil sector to exploration and production of light and medium crude to qualified foreign companies in partnership with the Government. Corporación Venezolana de Petróleo, would be PDVSA's representative in the joint-venture, profit-sharing partnerships. Venezuela's oil sector had been slowly opening to the private sector with previous participation in exploration of marginal fields and heavy crude. In 1995, Conoco Inc., a subsidiary of Dupont Co., and Maraven, a subsidiary of PDVSA signed a $1.7 billion agreement to convert heavy crude from the Orinoco belt to produce 100,000 barrels per day of light synthetic crude. Conoco also signed an agreement to produce Orimulsion, a 70% bitumen-30% water power plant fuel, in partnership with Bitúmines Orinoco S.A. (BITOR), Norway's Statoil, and a group formed by two Venezuelan engineering firms, Jantesa and Distral Térmica.[20] BITOR has long-term contracts to sell Orimulsion to Canada, Denmark, Lithuania, Japan, the United Kingdom.

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[1]Latin America Economy & Business, Mar. 1996, p. 5.
[2]U.S/Latin Trade, Sept. 1995, p. 25.
[3]Mining Journal, London, Dec. 8, 1995, p. 430.
[4]Latin American Economy and Business, Aug. 1995, p. 27.
[5]Mining Journal, London, June 30, 1995, p. 479.
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Ministerio de Energía y Minas
Caracas, Venezuela
Dirección General Sectorial de Minas
Ministerio de Energía y Minas
Caracas, Venezuela

TABLE 1
VENEZUELA: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
METALS						
Aluminum:						
Alumina		1,300	1,310	1,500	1,300	1,641
Bauxite	metric tons	1,990,000	1,050,000	2,910,000	4,419,173 r/	5,183,827
Metal, primary, unalloyed	do.	601,000	561,000	568,000	585,445 r/	629,828
Gold, mine output, Au content	kilograms	4,220	7,550	8,899	10,094 r/	7,259
Iron and steel:						
Iron ore and concentrate		21,200	18,100	16,871	18,318	19,484
Metal, Direct-reduced iron		4,020	4,230 r/	4,510	4,710	4,720
Ferroalloys:						
Ferromanganese		1	9	--	-- e/	-- e/
Ferrosilicomanganese		31	32	42	40 e/	40 e/
Ferrosilicon 2/		54	40	47	41	40 e/
Total		86	81	89	81 e/	80 e/
Steel, crude		3,315 r/	3,489 r/	3,392 r/	3,524	3,634
Semimanufactures, hot-rolled		2,210	2,450	2,560	2,390	3,080
Lead, secondary, refined	metric tons	15,000	15,000 e/	14,000 r/	15,000	16,000 e/
INDUSTRIAL MINERALS						
Amphibolite		212	200	--	50 r/	66
Cement, hydraulic		6,340	6,590	6,840	6,927	7,000 e/
Clays:						
Kaolin		39	41 r/	32 r/	10 r/	3
Other		2,750	1,630	1,920	2,434 r/	3,380
Diamond:						
Gem	carats	102,000	302,000	145,000	202,868 r/	229,016
Industrial	do.	112,000	176,000	155,000	214,311 r/	63,936
Total	do.	214,000	478,000	300,000 r/	417,179 r/	292,952
Feldspar		138	169	220	135 r/	170
Gypsum		244	175	224	135 r/	135
Nitrogen, N content of ammonia		450	404	535	505	600
Phosphate rock		162	10	--	98 r/	86
Pyrophyllite e/		32	32	32	32	32
Salt, evaporated	metric tons	430,000	318,000	370,000 e/	400,000 e/	350,000 e/
Serpentinite, crushed e/		550	550	550	550	550
Stone, sand and gravel:						
Stone:						
Dolomite		300 e/	275	250	300	300
Granite		370	47	195	264 r/	236
Limestone		11,400	14,300	12,654 r/	11,687 r/	12,233
Marble		--	134	--	--	--
Sand and gravel		4,608	4,940	5,030	4,165 r/	4,629
Silica sand		343	703	753	141 r/	598
Sulfur, petroleum byproduct		155	155	135	158 r/	180
MINERAL FUELS AND RELATED MATERIALS						
Carbon black e/		60	60	60	60	60
Coal, bituminous		2,696 r/	2,479 r/	3,958 r/	4,628	4,700 e/
Gas, natural:						
Gross	million cubic meters	42,300	43,400	42,500	44,487 r/	45,000 e/
Marketed e/	do.	15,000	15,000	15,000 3/	15,100	15,000

See footnotes at end of table.

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TABLE 1--Continued
VENEZUELA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

Commodity		1991	1992	1993	1994	1995
MINERAL FUELS AND RELATED MATERIALS--Continued:						
Natural gas liquids: 4/						
Natural gasoline	thousand 42-gallon barrels	8,190 e/	18,600	7,900	11,300 e/	11,300 e/
Liquid petroleum gas	do.	33,300 e/	74,500	38,800	49,275 r/	50,000 e/
Total	do.	41,490 e/	93,100	46,700	60,575 r/	61,300 e/
Petroleum:						
Crude	do.	872,000	907,000	816,000	955,351 r/	868,153
Refinery products:						
Liquified petroleum gas	do.	3,000 e/	3,500 e/	2,920	3,290	3,300 e/
Gasoline:						
Aviation	do.	350	300 e/	64 e/	--	--
Motor	do.	115,000	105,000 e/	68,900	68,800	70,000 e/
Naphtha e/	do.	6,000	12,000	58,000 3/	50,500	51,000
Jet fuel	do.	28,100	29,000 e/	28,500	27,700	28,000 e/
Kerosene	do.	803	1,000 e/	999	--	500 e/
Distillate fuel oil	do.	107,000	100,000 e/	104,000	93,800	94,000 e/
Lubricants	do.	2,950	2,950 e/	3,320	2,750	2,800 e/
Residual fuel oil	do.	107,000	105,000 e/	102,000	96,400	97,000 e/
Asphalt and bitumen	do.	9,040	10,000 e/	8,230	10,300	10,500 e/
Refinery fuel gas e/	do.	9,100	9,000	27,900 3/	9,000	9,000
Unspecified e/	do.	1,210	1,500	1,240	2,320 3/	2,400
Total e/	do.	389,553	379,250	406,073	364,860	368,500

e/ Estimated. r/ Revised.

1/ Table includes data available through Aug. 1996.

2/ Figures represent combined 45%-silicon-content and 75%-silicon-content production.

3/ Reported figure.

4/ From nonassociated gas only.

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TABLE 2
VENEZUELA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	C.V.G. Bauxalum C.A. (Government, 88.7%; Aluminio Suizo S. A., 11.3%)	Ciudad Guayana, Bolívar State	2,000
Aluminum	Aluminio del Caroní S. A. (Alcasa) (Government, 82%; Reynolds International, Inc. 8%)	do.	300
Do.	Industria Venezolana de Aluminio C. A. (Venalum) (Government, 80%; Six Japanese companies, 20%)	do.	366
Bauxite	C.V.G. Bauxalum C.A.	Los Pijiguaos, Bolívar State	6,000
Cement	C. A. Venezolana de Cementos (Vencemos) (CEMEX)	Barquisimeto, Lara State; Maracaibo, Zulia State; Pertigalete, Anzoátegui State	(clinker) 5,265
Do.	C.A. Fábrica Nacional de Cementos (46.13% Lafarge)		(clinker) 1,770
Coal	Carbones del Guasare S. A. (Carbones de Zulia S.A., owned by PDVSA)	Paso Diablo, Zulia State Guasare coal basin	4,000
Gold kilograms	Revemin (Monarch, 51%, C.V.G., 49%)	El Callao, Bolívar State	(mill) 900
Do. do.	Crystallex de Venezuela C.A. (100% Crystallex International Corp.)	Albino mine, Kilometro 88, Bolívar State	(mill) 1,500
Do.	Las Cristinas (Placer Dome 70%; C.V.G. 30%)	Kilometro 88, Bolívar State	new
Iron ore	C.V.G. Ferrominera del Orinoco C. A. (Government, 100%)	Cerro Bolívar, El Pao, Los Barrancos, and San Isidro mines, Bolívar State	20,000
Iron ore pellets	do.	Ciudad Guayana, Bolívar State	3,300
Nickel	Jordex Resources and Corporación de Caracas, 90%; Anglo American of South America, 10%)	Loma de Hierro, Aragua/Miranda States	new
Petroleum:			
Crude million 42- gallon barrels	Petróleos de Venezuela S.A. (PDVSA) (Government, 100%)	Fields in Anzoátegui, Apure, Falcón, Guárico, Monagas, and Zulia States	1,100
Refinery products do.	do.	Major refineries at Amuay Bay and Cardón, both in Falcón State	400
Steel	C.V.G. Siderúrgica del Orinoco C.A. (Sidor) (Government, 100%)	Ciudad Guayana, Bolívar State	4,300

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